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ABSTRACT

Intended for instructors serving the occupational needs of disadvantaged and handicapped students, this curriculum guide contains 16 units for a small engine maintenance program. Its purposes are to provide minimum skills of students already mainstreamed, and provide vocational instructional materials for the modified classroom. Teachers should adapt these self-paced and self contained instructional materials to suit teaching/learning situations. The 16 units cover these areas/topics: job opportunities, safety rules, small engine tools and their uses, small engine parts and their uses, fuel selection and use (two-cycle), inspecting and servicing spark plugs, cleaning and inspecting cooling system, servicing air cleaners, cleaning and inspecting crankcases and exhausts, changing oil in four-cycle engine, checking carburetor, preparing for carburetor adjustments, adjusting carburetor choke and high speed load valve, checking ignition system, and starting and operating small engines. Each unit contains these sections: (1) unit objectives and self assessment statements; (2) introduction (motivational statement); (3) description of tools, materials, and equipment; (4) steps of procedure (explanation and illustration of given skill); and (5) student evaluation (true-false, identification, or steps of procedure). (YLB)

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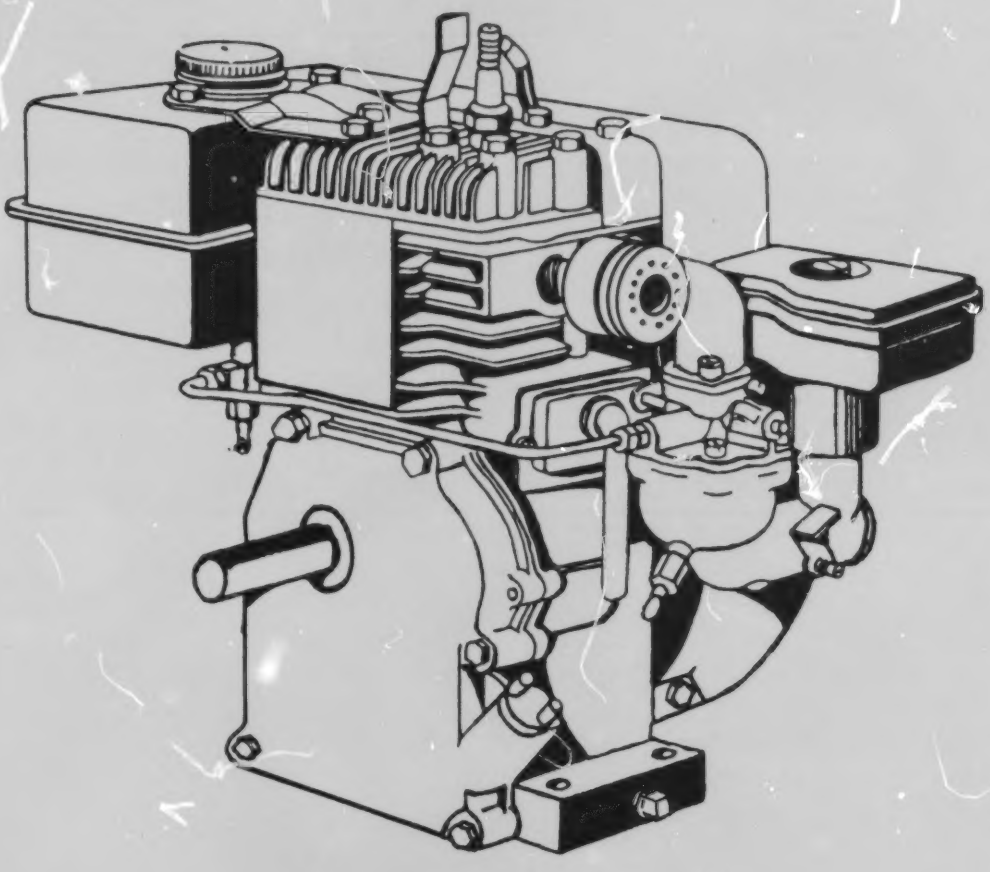
Vocational Preparation Curriculum



Maintaining Small Engines

Developed by: Amon Herd
Associate Director
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CE030515

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Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES

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June 1981

Catalog Number SN-9-S

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES

Preface

This Vocational Preparation Curriculum guide is a Special Needs project sponsored by the Missouri Department of Elementary and Secondary Education. The purpose of this curriculum guide is threefold:

1. to provide minimum skills for disadvantaged and handicapped students entering the mainstream
2. to supplement vocational skills of those students already in a regular training program (mainstream)
3. to provide vocational instructional materials for the modified classroom

This guide is intended to be a workable guide for instructors serving the occupational needs of various categories of Disadvantaged and Handicapped students.

Sixteen units of self-paced and self-contained instructional materials are contained within this maintaining small engines curriculum. Units are illustrated and simplified to more easily aid the student in class activities or on an individual basis.

Each unit within the small engines curriculum is color coded to represent a separate section within the unit, the color coding is explained as follows:

White: Objective and Student Assessment - This sheet presents the unit objectives. The student must meet these objectives to successfully complete the unit.
The self-assessment statements help the students to determine their ability to perform the unit objectives.

Goldenrod: Introduction - Contains a brief motivational statement describing the theme of the unit.

Salmon: Tools, Materials, and Equipment - This section introduces new tools, materials, and equipment necessary for a given psychomotor skills lesson.

Canary: Steps of Procedure - Presents a step by step explanation and illustration of a given skill.

Pink: Student Evaluation - These sheets are used by the instructor to evaluate student performance. Three different forms of evaluation are presented; true-false, identification, and Steps of Procedure evaluation.

It should be noted that the material within this curriculum was developed to provide a source and guideline for the instructor. The responsibility of the instructor will be to adapt material as is necessary to suit a given teaching/learning situation. It is hoped that this material will provide that basis.

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES

Acknowledgments

The Vocational Preparation Curriculum guide is the outcome of the expenditure in time, effort and talents of the following individuals.

Committee Members:

Ed Flanigan, Instructor, Waynesville Area Vocational-Technical School

Steve Parker, Instructor, Rolla Area Vocational-Technical School

Jim Walker, Instructor, Cass County Area Vocational-Technical School, Harrisonville, MO

Robert Wagner, Instructor, Graff Area Vocational-Technical School, Springfield, MO

Mr. Miles Beachboard, Director of Vocational Special Needs Programs, Department of Elementary and Secondary Education, Jefferson City, Missouri

Mr. Larry Lutz: Director, Camdenton Area Vocational-Technical School

In preparing this curriculum, we wish to acknowledge the contributions made by Hogan Usoro, Research Assistant, Instructional Materials Lab. Through his time and effort, Vocational Preparation Curriculum, Maintaining Small Engines originated.

Instructional Materials Laboratory, University of Missouri-Columbia

Greg Leech: Graphic layout specialist for illustration, design and paste-up work

Tammy Begley, Mitzi Groves, and Shelly Brand: Composition typists, for their work in typesetting and editing

Phyllis Miller: Editor, for editing the curriculum material

Dr. Harley Schlichting: Director of Instructional Materials Laboratory, for assistance in the preparation and completion of this Vocational Preparation Curriculum

Appreciation is also expressed to Dr. F.M. Miller of the Practical Arts and Vocational-Technical Education department and Dr. C.T. Cameron, Special Education department, University of Missouri-Columbia, for their contributions toward the development of the format in this curriculum.

Special thanks are due the following for information and illustrations:
American Association for Vocational Instructional Materials and Briggs & Stratton Corporation.

References

Small Engines, Volume I, Care and Operation. Athens Georgia: American Association for Vocational Instructional Materials, 1979.

Small Engines, Volume II, Maintenance and Repair. Athens, Georgia: American Association for Vocational Instructional Materials, 1979.

Repair Instructions IV. Milwaukee, Wisconsin: Briggs & Stratton Corporation.

Mechanic's Handbook, Light and Medium Frames. Grafton, Wisconsin: Tecumseh Products Company.

Notes to the Instructor

Step 1 Read through the information in this unit before presenting it to the student.

Step 2 Make sure all tools and materials to be used in this unit are available.

Step 3 Prepare any handouts, if applicable, to aid student learning activities.

Step 4 Provide the student with self-assessment (objective) sheet.

Step 5 Discuss tasks on self-assessment sheet and give directions for completing the Show What You Can Do section.

Step 6 Have student complete self-assessment sheet.

Step 7 If the student elects to take the Practical Exercise and completes it to the satisfaction of the instructor, have the student proceed to the next package. If the student fails to complete the Practical Exercise to your satisfaction or does not wish to take the exercise, proceed to Step 8.

Step 8 Provide and discuss the Introduction sheet with the student. At this time you can also discuss the Tool, Materials and Equipment list.

Step 9 Provide the student with Steps of Procedure.

Step 10 Present the Steps of Procedure. Depending on the capabilities of the student, select one or more of the following means of presentation:

a. have student study information independently,
or
b. go through the Steps of Procedure with the student individually or as a group.

Step 11 Instructor can demonstrate the procedures to the student or the group.

Step 12 Allow the student time to practice the procedure.

Step 13 When the student feels ready, use the Practical Exercise Checklist to evaluate the student's performance capabilities.

Additional Suggestions

Try team approach when possible.

Beginning students can work together after instructor's demonstration.

One student experienced with the procedures can work with a beginner.

For non-readers, audiotapes or videotapes of the lesson could be prepared.

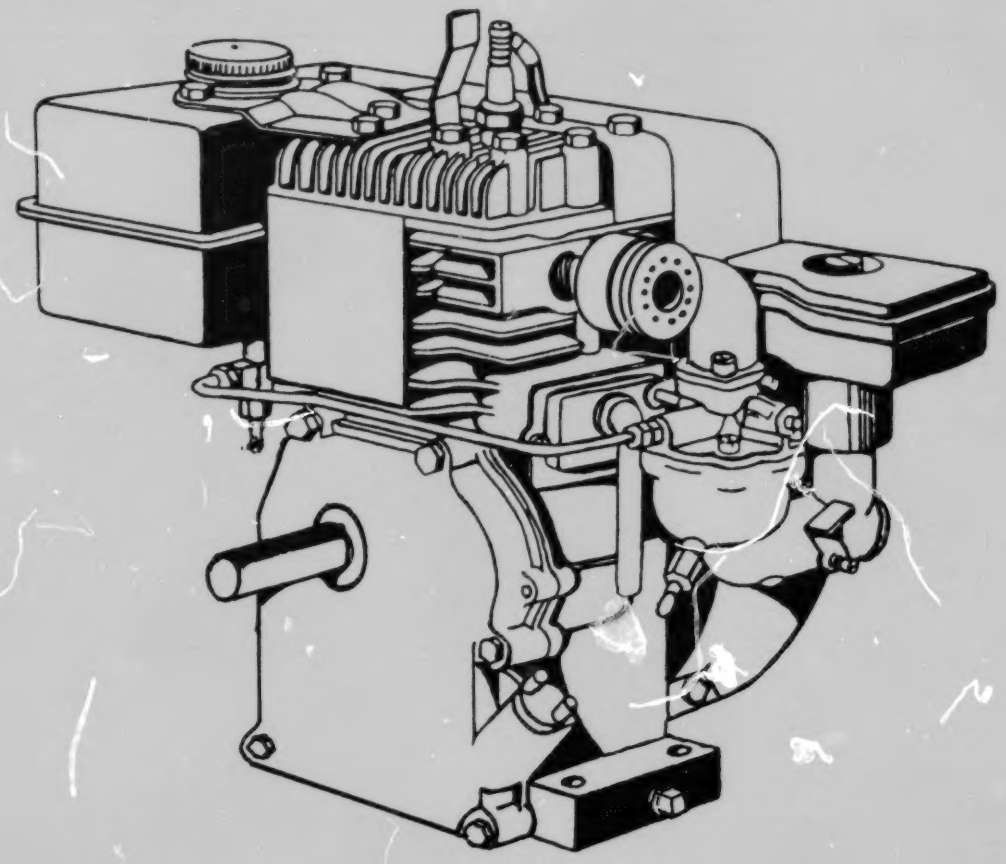
Plan visits to local small engine shops.

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES

Class Progress Chart

Student's Name	WHAT THE STUDENT CAN DO
	Properly Use Small Engine Tools
	Identify Small Engine Parts
	Safely Select and Use Fuel
	Inspect and Service Spark Plugs
	Clean and Inspect the Cooling System
	Service Small Engine Air Cleaners
	Clean and Inspect Crankcase and Exhausts
	Change the Oil in a 4-Cycle Engine
	Check the Carburetor for Proper Operation
	Prepare for Carburetor Adjustments
	Adjust the Carburetor Choke
	Adjust the High Speed Load Valve
	Check the Ignition System
	Start and Operate Small Engines
	Instructor's Signature Date

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 1

Jobs Related To Small Engines

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Unit 1
Jobs Related To Small Engines

Jobs Related To Small Engines

After you study this lesson, you should be able to:

1. Name and locate a small engine shop in your community.
2. Identify jobs related to small engines.

Show What You Can Do.

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

TURN THE PAGE AND BEGIN

Unit 1
Jobs Related To Small Engines

Introduction

Over 75 million small engines are in use and six million small engines are produced every year. Many jobs are available for you in small engine occupations. There will always be a need to replace small engine workers who are promoted or retired.

The training you receive will help you to get a job in the small engine field. In this unit you will learn about small engine jobs in different places.

TURN TO NEXT PAGE

Unit 1
Jobs Related To Small Engines

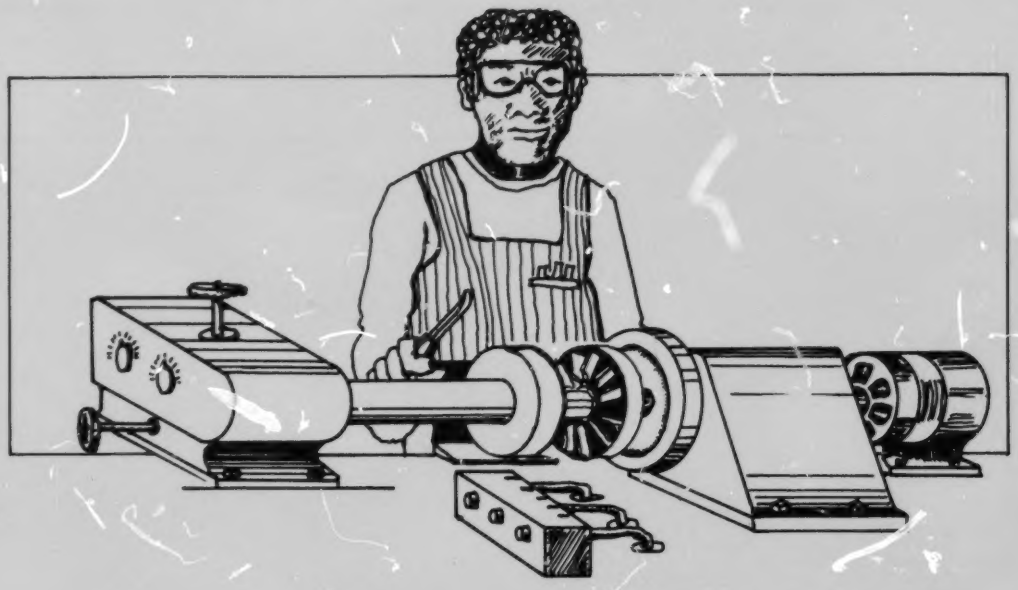
A. Employment Areas in Small Engines.

There are many areas of employment in small engines. Service of small engines is very rewarding. In sales you work with the public and in manufacturing you learn how to build engines.

1. **Service:**

2. **Sales:**

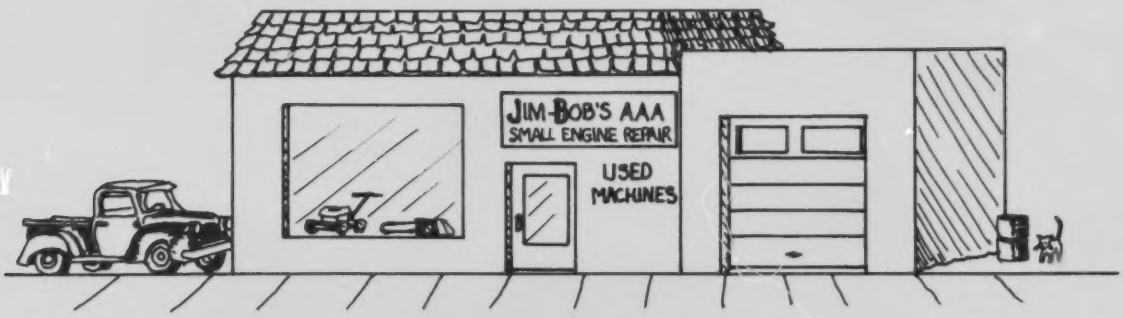
3. **Manufacturing:**



4. **Name and locate a small engine shop in your area.**

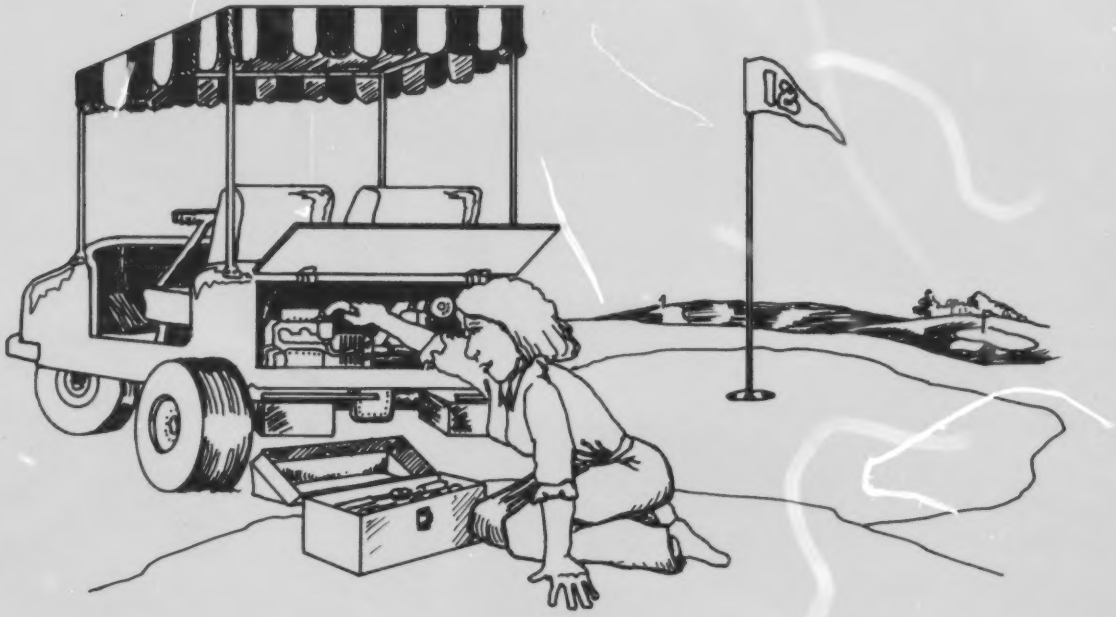
B. Jobs Related To Small Engines.

1. **SELF-EMPLOYMENT:** Operate your own repair shop for small engines. Be responsible for fixing lawn mowers and other small engines.

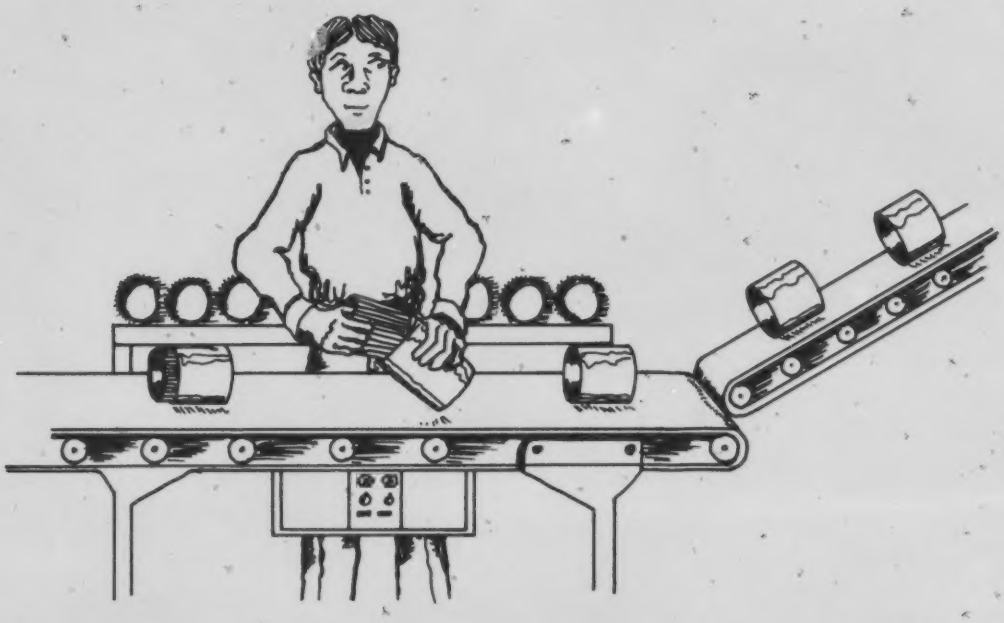


2. **REPAIR PERSON:** Work in service department repairing small engines.

3. **MAINTENANCE PERSON:** Keeps small engines in working order for golf courses, schools and parks.

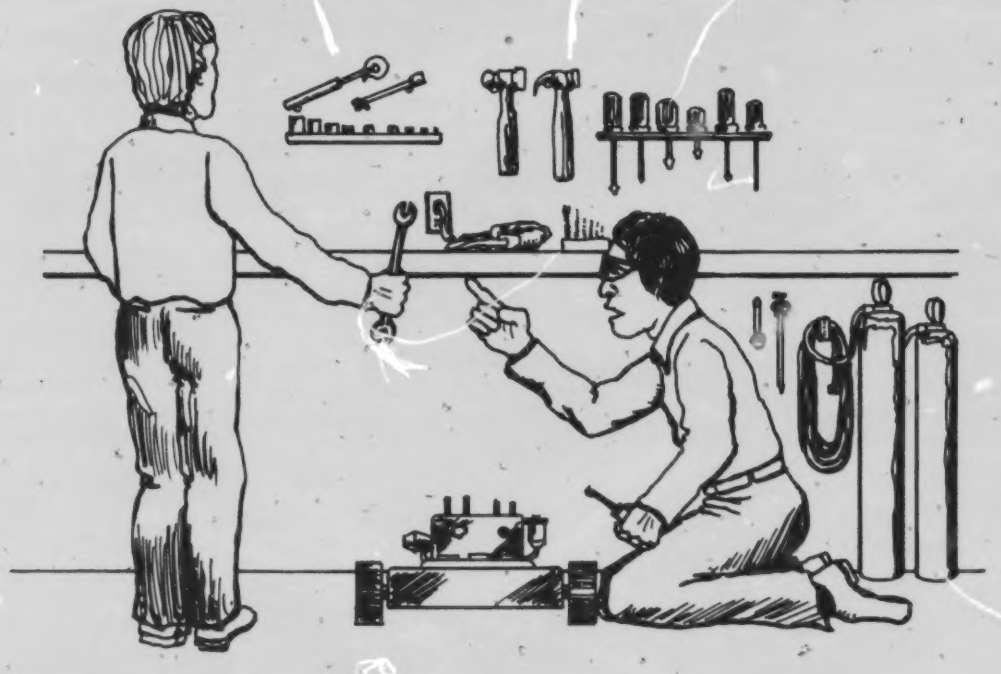


4. **ASSEMBLY LINE WORKER:** Helps build new small engines in a factory.



5. **PARTS CLERK:** Orders and stocks parts and equipment for small engines.

6. **SHOP ASSISTANT:** Works with mechanic to assemble lawn mowers, chain saws and other small engines; sharpens and balances blades, keeps tools and shop equipment in order.



You have learned about jobs related to small engines and employment areas in small engines.

Try to answer the following questions:

1. Which small engine job would you like?

2. Why would you choose that job?
   Discuss reasons with the instructor.

SEE YOUR INSTRUCTOR

Unit 1
Jobs Related To Small Engines

Practical Exercise Performance Checklist

Student's Name: _____

Match the job titles with their descriptions.

___ 1. Works with mechanic, assembles lawn mowers and keeps tools and shop equipment in order.

___ 2. Orders and stocks parts and equipment for small engines.

___ 3. Keeps small engines in working order for golf courses, schools and parks.

___ 4. Helps build new small engines in a factory.

___ 5. Sells small engine equipment

___ 6. Works in service department repairing small engines

___ 7. Operates their own repair shop

a. Self-Employed

b. Salesperson

c. Repairperson

d. Maintenance Person

e. Assembly Line Worker

f. Parts Clerk

g. Shop Assistant

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

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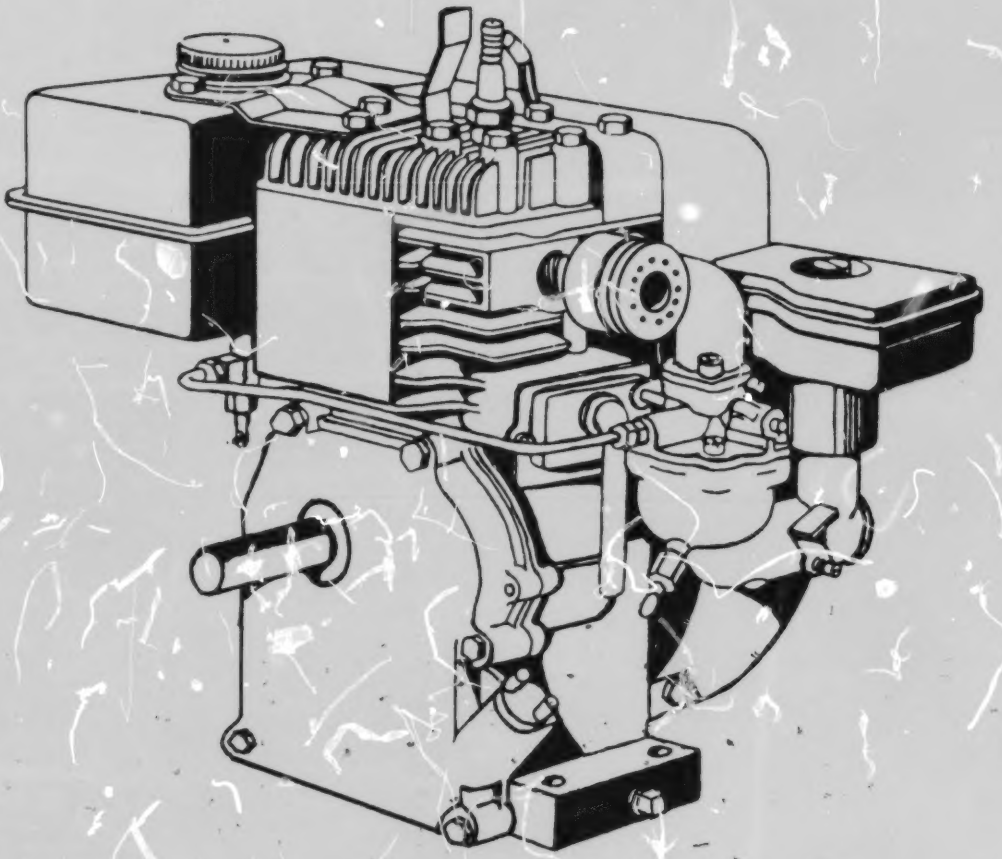
MAINTAINING SMALL ENGINES



Unit 2

Safety Rules In Small Engines

PRACTICAL ARTS
AND
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Unit 2
Safety Rules In Small Engines

Safety Rules In Small Engines

After you study this lesson, you should be able to:

1. Identify unsafe work habits when working with small engines.
2. Perform skills safely in a small engine shop.

Show What You Can Do

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

TURN THE PAGE AND BEGIN

Unit 2
Safety Rules In Small Engines

Introduction

Working in a small engine shop can be enjoyable and safe if you follow safety rules. As you work, always ask yourself if the job is being done safely.

In this unit, you will learn about some safety rules you must observe while working with small engines.

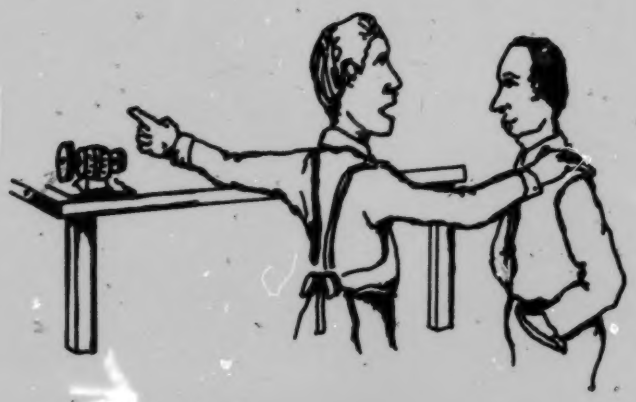
Use exhaust vent to remove fumes from running engine.

TURN TO NEXT PAGE

Unit 2
Safety Rules In Small Engines

Always wear safety equipment, clothing and shoes as required.

Always do your work in a manner that protects other people.



Operator's Manual - Study your operator's manual. Make sure you know where and how controls work.

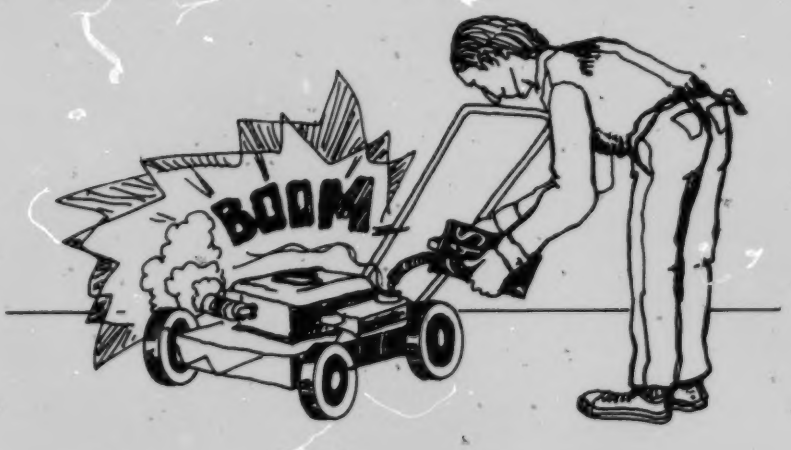
Moving Parts - Stay away from moving parts because your clothing can get caught in them.

Gasoline - Be careful not to spill gasoline. If you accidentally spill gas, clean it properly to avoid fires.

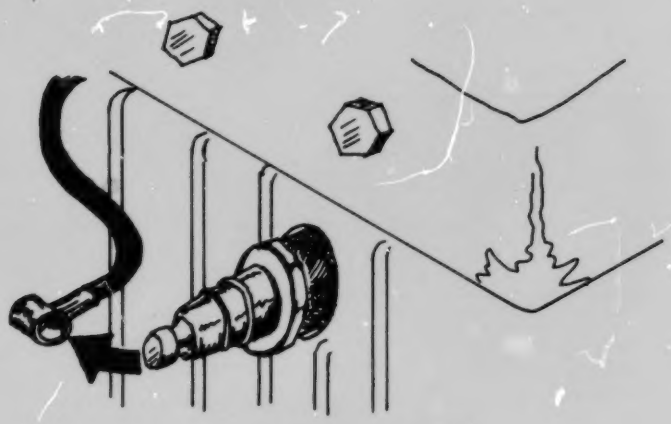
Oily Floors - Always keep floors free of oil to prevent accidents.

Starting Engines - Always allow enough room for pulling the rope starter to avoid injuring yourself or others.

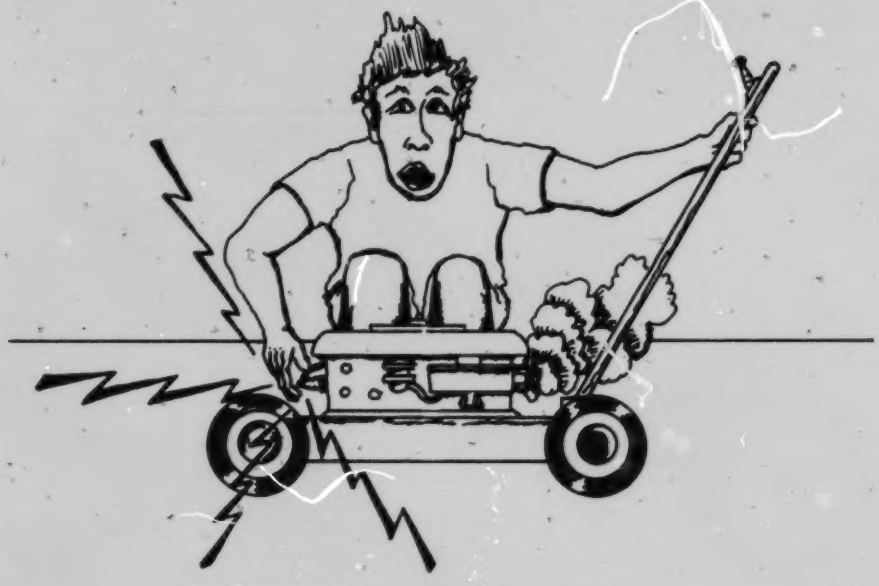
Never fuel a gasoline engine while it is running.



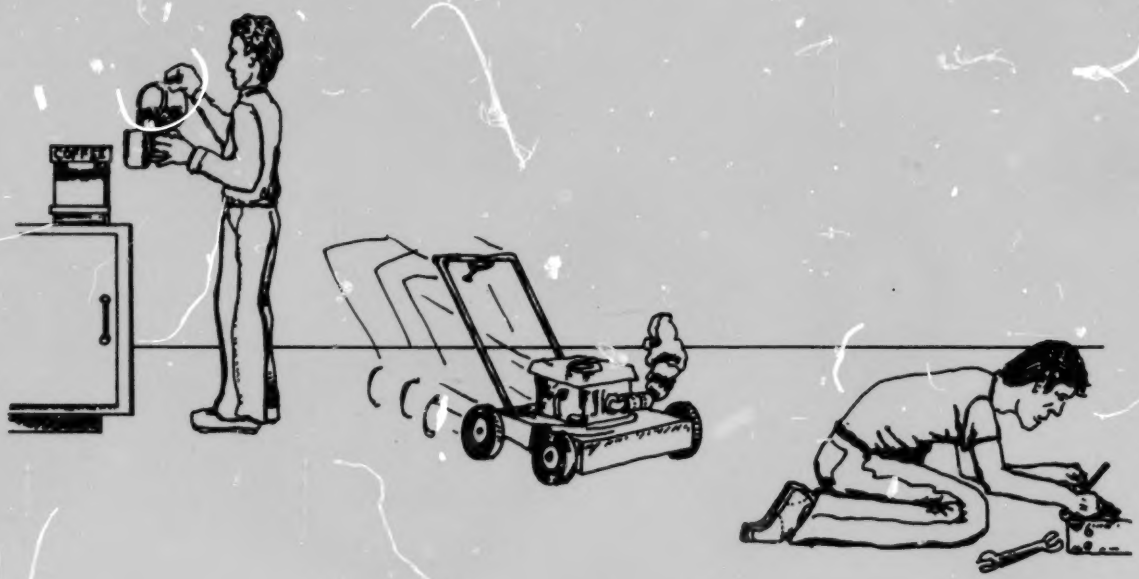
Always disconnect spark plug wire from engine when working on the machine. This will keep engine from starting.



Never make adjustments on machinery while engine is running.



Never leave an engine running without someone nearby.



Using Hand Tools - Make sure your hands and tools are free of dirt and grease.
Always use proper type and size hand tool.

Always report accidents to your instructor, no matter how small they may seem to be.

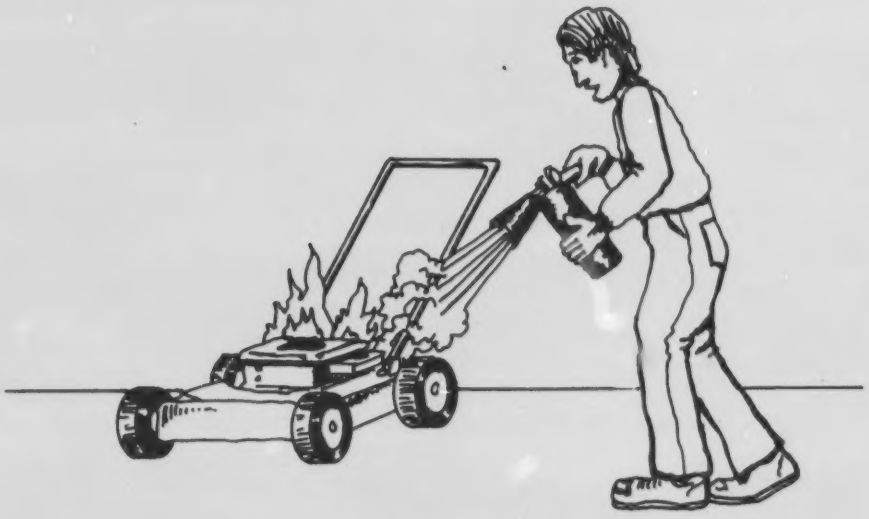
Always ask questions about anything you do not understand.

Always obtain permission from your instructor before using any cleaning equipment.

Never use gasoline to clean parts.

Wear protective clothing when cleaning parts.

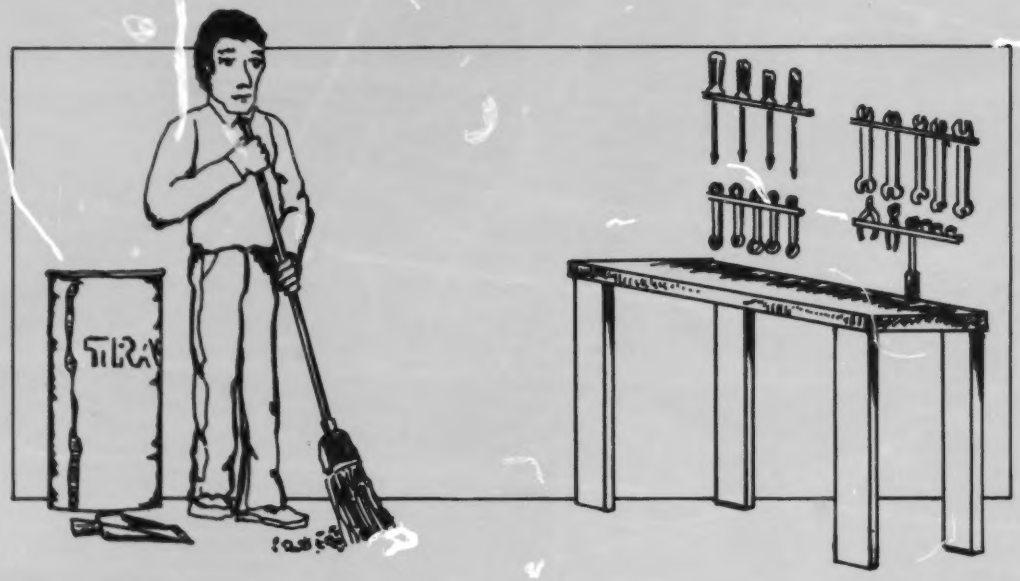
Always have a fire extinguisher and fire blanket close by.



Starting Engine - Before starting an engine, check around and under lawn mower for tools, objects and feet.

Horseplay - Always take your work seriously instead of horseplaying and risking an accident.

Work Completed - Always clean your work area after you finish your job.
Clean and return tools to their proper place.



Instructions: Always follow instructions to insure safety.

SEE YOUR INSTRUCTOR

Unit 2
Safety Rules in Small Engines

Practical Exercise Performance Checklist.
Student's Name:_____

True-False Questions:
Circle "T" if the statement is true and "F" if it is false.

T F 1. Always obtain permission from your instructor before starting a small engine.

T F 2. Gasoline should be used to clean parts.

T F 3. An exhaust vent must be used when running an engine inside.

T F 4. You should always have a fire extinguisher and fire blanket close by when you are working on small engines.

T F 5. Always make the needed adjustments while your small engine is running.

T F 6. It is safe and suitable for you to wear loose clothing and jewelry when working on small engines.

T F 7. Gasoline can be safely stored in plastic jugs.

T F 8. Rags containing oil, gasoline or solvent should be thrown with other trash.

T F 9. You should always wear safety glasses when using an air hose.

T F 10. Make sure the area under and around the equipment is clear before starting engine.

T F 11. Always remove the spark plug wire before working on the engine.

T F 12. A fire extinguisher is a device used to put out fires.

Unit 2
Safety Rules in Small Engines

Safety Equipment Location Activity.

Can you locate these safety devices in your school shop?

Yes	No	
☐	☐	a. fire extinguisher
☐	☐	b. safety glasses
☐	☐	c. metal container for oily rags
☐	☐	d. proper container for gasoline storage
☐	☐	e. fire blanket
☐	☐	f. exhaust vents in the shop

Check with your instructor if you cannot find any of the above.

What other safety devices would you want in your shop?

Unit 2
Safety Rules In Small Engines

Practical Exercise Performance Checklist

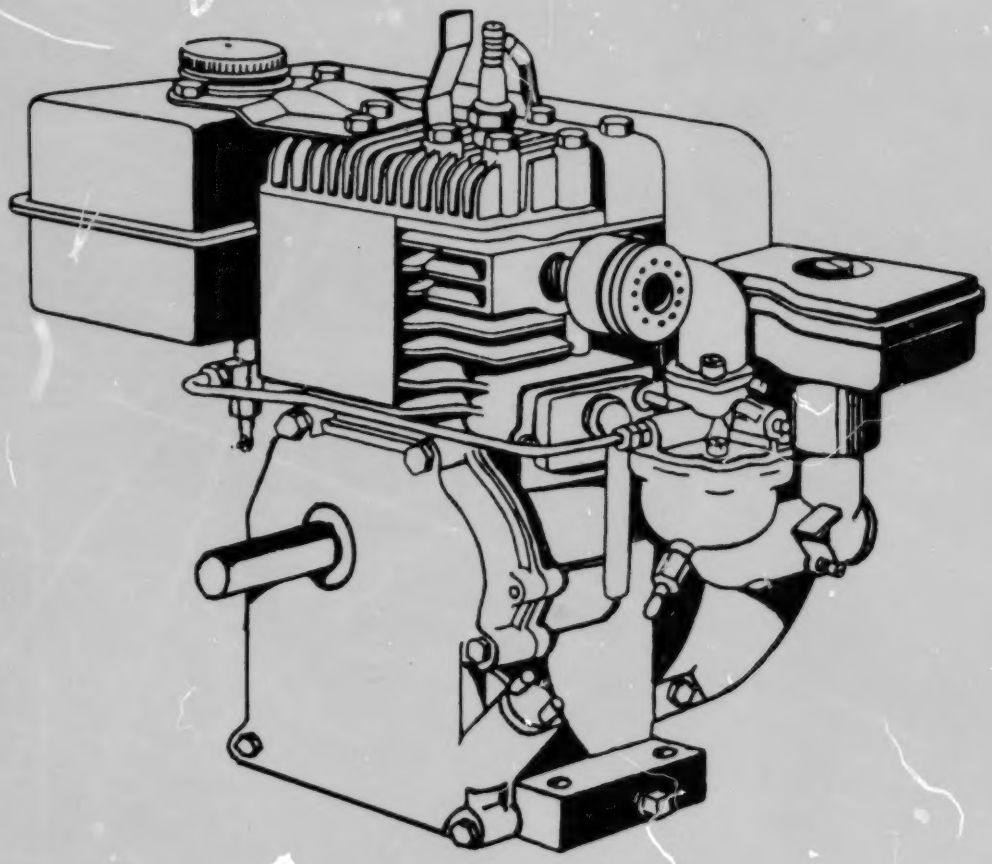
Name:_____

Safety Tasks	Yes	No	Comments
1. Wears safety equipment as required			
2. Uses exhaust vent when running engines			
3. Has studied operator's manual and knows how controls work			
4. Knows to get permission from instructor before starting engine			
5. Never fuels an engine while it is running			
6. Disconnects spark plug wire from engine before work begins			
7. Never makes adjustments on machinery while it is running			
8. Never leaves an engine running without someone nearby			
9. Uses hand tools safely and correctly			
10. Reports any accident to the instructor			
11. Always asks questions about anything not understood			
12. Always obtains permission before using cleaning equipment			
13. Knows how to use fire equipment			
14. Checks and clears area under and around lawn mower before starting			
15. Always cleans work area and returns tools to proper places			
16. Follows instructions			
17. Dicusses problems with instructor			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 3

Small Engine Tools and Their Uses

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Unit 3
Small Engine Tools and Their Uses

Small Engine Tools and Their Uses

After you have studied this lesson, you should be able to:

1. Identify basic tools used in repairing or servicing small engines.
2. Identify a small engine tool with its use.

Show What You Can Do

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

TURN THE PAGE AND BEGIN

Unit 3
Small Engine Tools and Their Uses

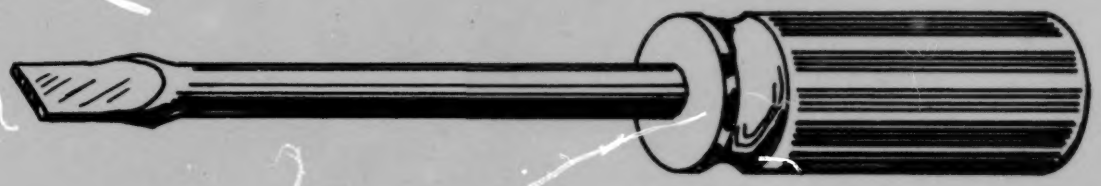
Introduction

You cannot do work on small engines without knowing about the tools needed. In this lesson, you will learn about common and special tools used in small engine work. Some frequently used tools are screwdrivers, wrenches, a flywheel puller and feeler gauges.

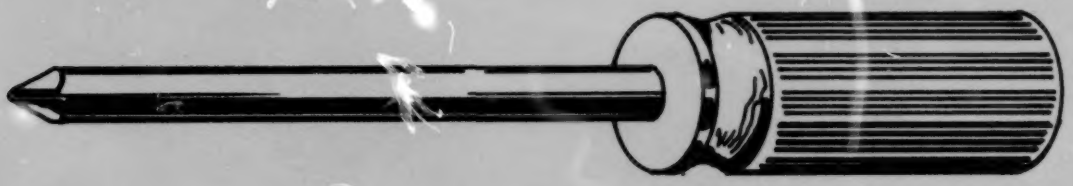
Tool identification and proper use is important to do a good job safely.

Unit 3
Small Engine Tools and Their Uses

1. **FLAT BLADE SCREWDRIVER:** Used to remove or install screws.



2. **PHILLIPS SCREWDRIVER:** Used to remove or install phillips screws.

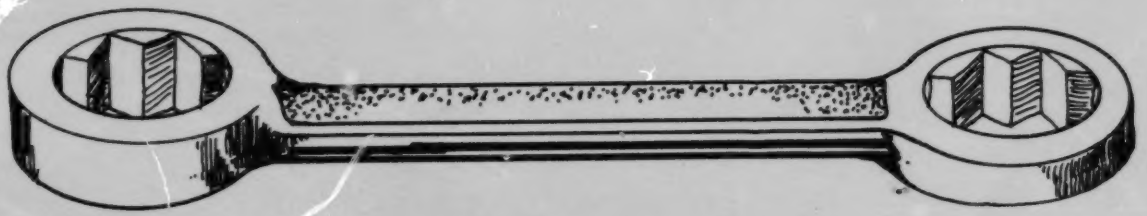


3. **OFFSET SCREWDRIVER:** Used to reach and turn a screw that is difficult to reach with an ordinary screwdriver.

4. **ALLEN WRENCH:** Six-sided wrench used to remove or install allen screws.

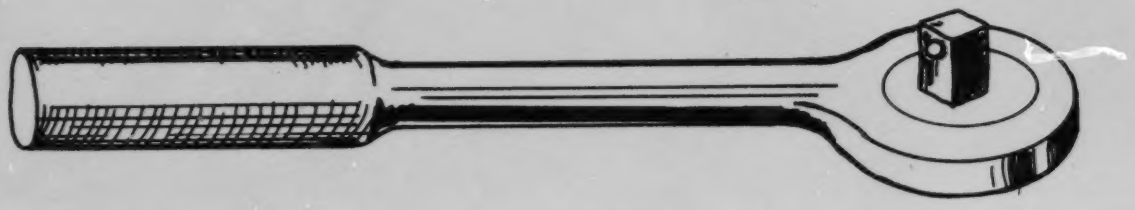
5. **OPEN-END WRENCH:** Used to loosen or tighten nuts and bolts.

6. **BOX-END WRENCH:** Used to loosen or tighten nuts and bolts.

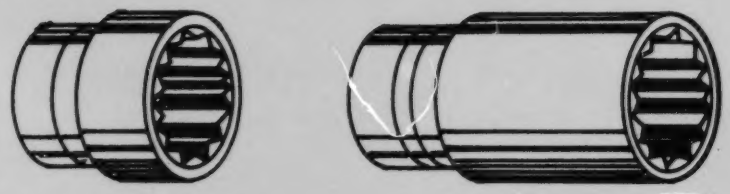


7. **ADJUSTABLE WRENCH:** Used to loosen or tighten various sizes of nuts and bolts by adjusting its jaws.

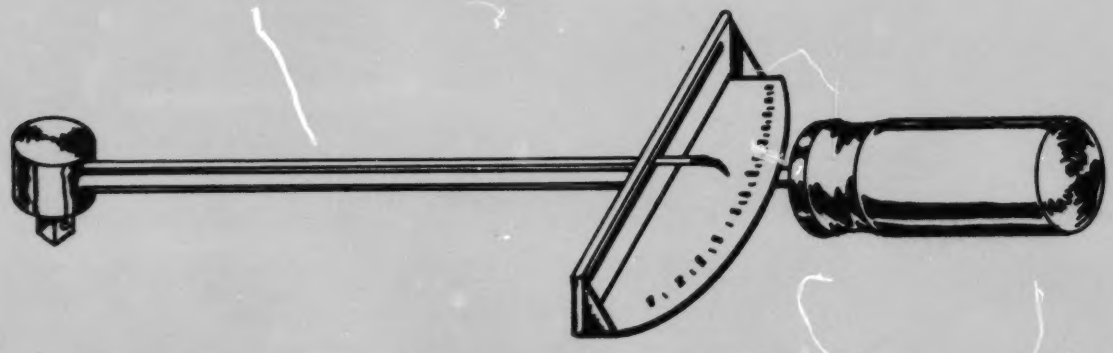
8. **SOCKET WRENCH:** Ratchet used with sockets for small engine repair work.



9. **SOCKETS, STANDARD OR DEEP:** Attached to a socket wrench and used to loosen or tighten nuts and bolts.

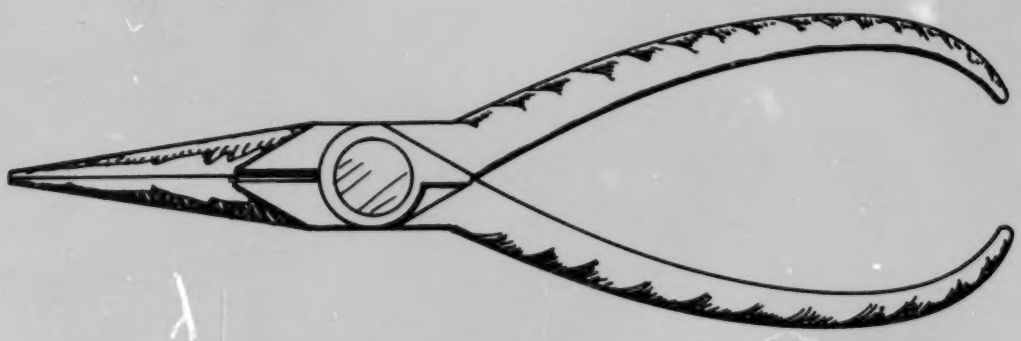


10. **TORQUE WRENCH:** Used for measuring pressure being applied to a nut.

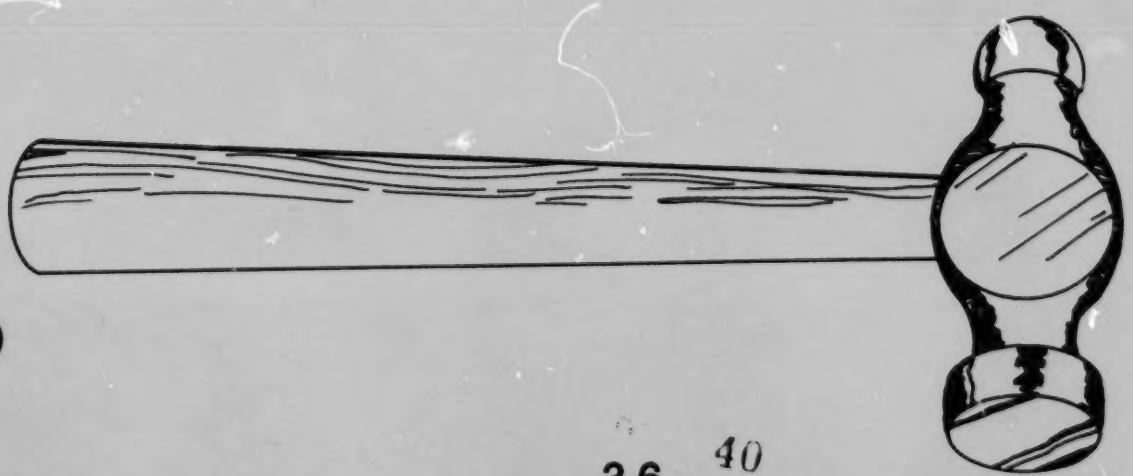


11. **CUTTING PLIERS:** Used to cut wire and remove flywheel key.

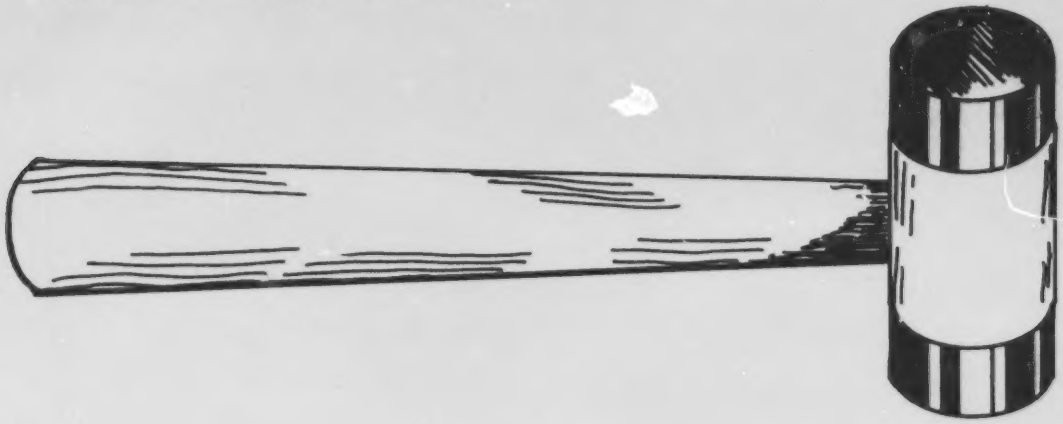
12. **LONG NOSE PLIERS:** Used for cutting wire and installing spring in ignition.



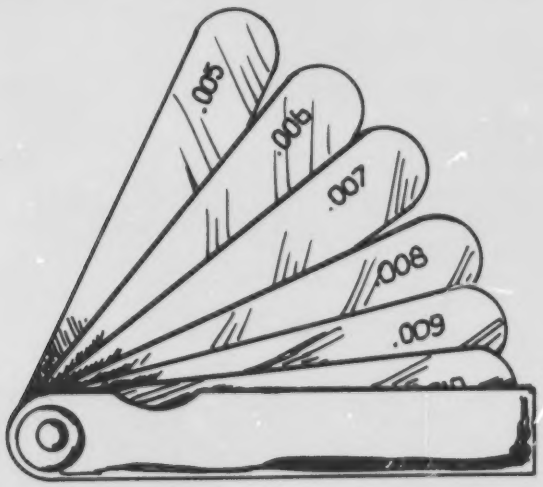
13. **BALL PEEN HAMMER:** Used to drive, pound, flatten or shape an object.



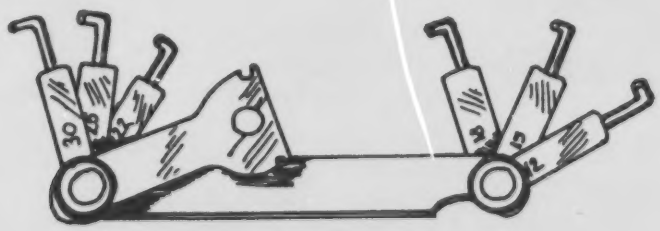
14. **SOFT FACE HAMMER:** Used to remove flywheel nut and prevent damage to engine.



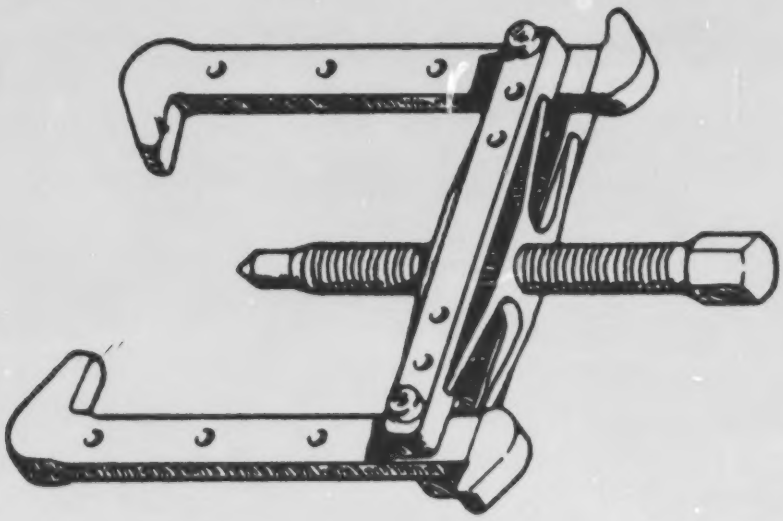
15. **FLAT FEELER GAUGE:** Used to set points in ignition.



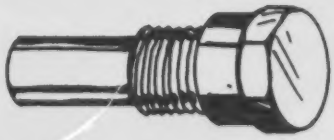
16. **WIRE FEELER GAUGES:** Used to check clearance on spark plugs.



17. **FLYWHEEL PULLER:** Used to remove flywheel and blade adapter.



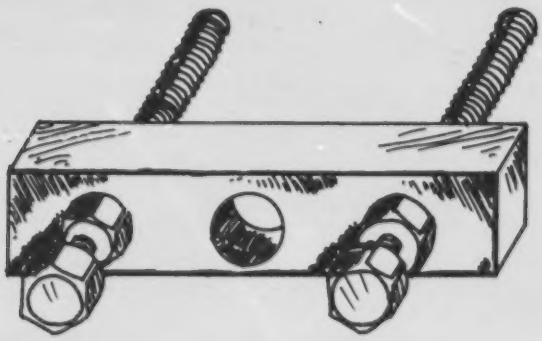
18. **PISTON STOP:** Used to stop piston movement when removing flywheel or blade.



19. **STARTER CLUTCH WRENCH:** Used to remove clutch from small engine.

20. **FLYWHEEL HOLDER:** A special tool used to hold the flywheel.

21. **SPECIAL FLYWHEEL PULLER:** A special tool used to remove the flywheel.



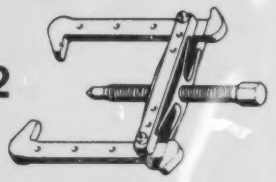
SEE YOUR INSTRUCTOR

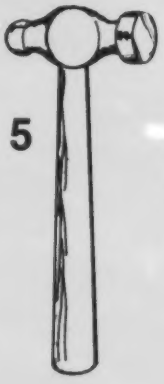
Unit 3
Small Engine Tools and Their Uses

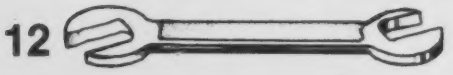
A. Tools Identification Exercise

Match the following tools with their correct names.

____ A. Phillips Screwdriver
____ B. Open-end Wrench
____ C. Box-end Wrench
____ D. Socket
____ E. Long-nose Pliers
____ F. Socket Wrench
____ G. Ball Peen Hammer
____ H. Cutting Pliers
____ I. Adjustable Wrench
____ J. Wire Gauges
____ K. Flywheel Puller
____ L. Allen Wrench





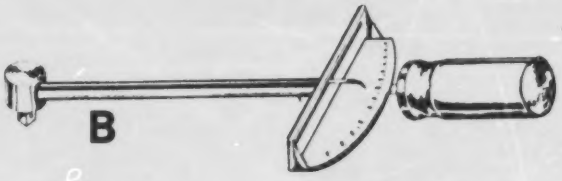


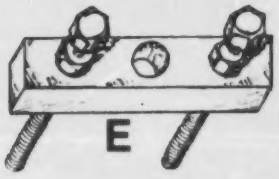
Unit 3
Small Engine Tools and Their Uses

B. Tools Identification Exercise

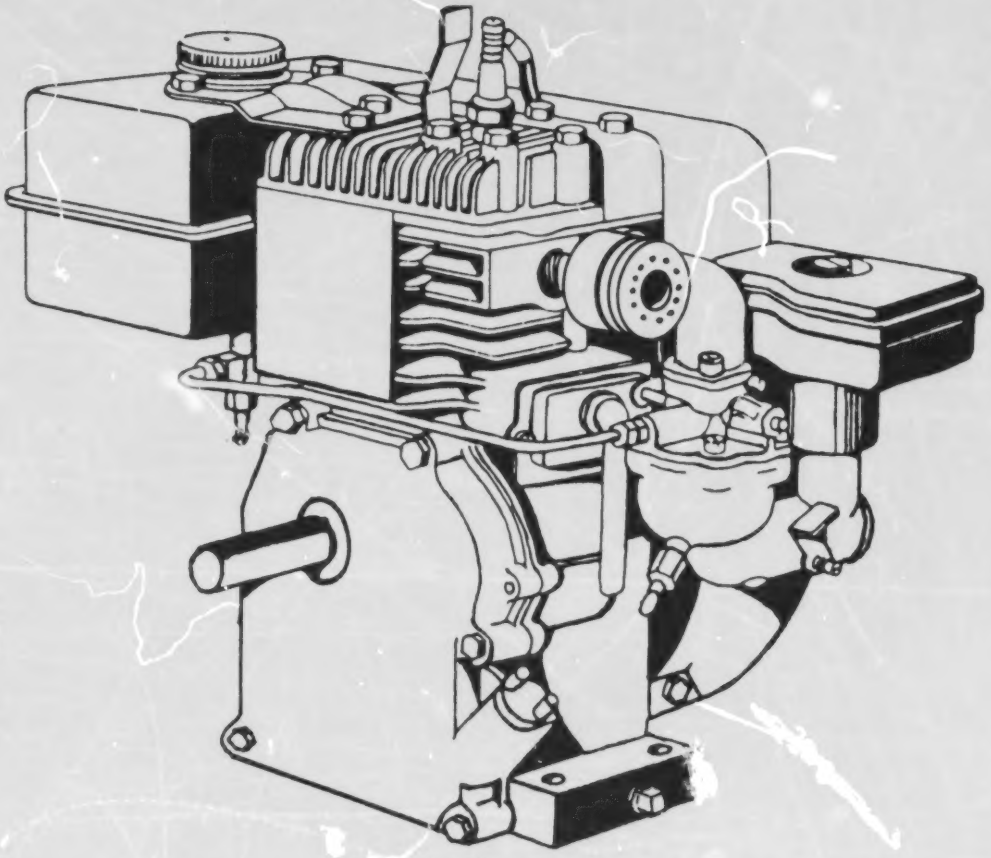
Match the following tools to their correct use:

___ 1. A tool used to remove the clutch on small engines.
___ 2. Checks pressure being applied to a nut or bolt.
___ 3. A special tool used to remove the flywheel on small engines.
___ 4. A tool used to hold the flywheel.
___ 5. Used for measuring clearance on spark plugs.
___ 6. Used for stopping movement of piston.





Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 4

Small Engine Parts and Their Use

PRACTICAL ARTS AND VOCATIONAL-TECHNICAL EDUCATION
IMI
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Unit 4
Small Engine Parts and Their Use

Small Engine Parts and Their Use

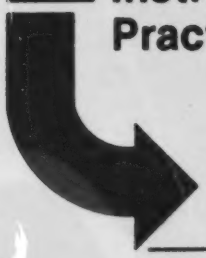
After you study this lesson, you should be able to:

1. Identify parts of a small engine.
2. Identify a given engine part with its use.

Show What You Can Do.

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**



SEE YOUR INSTRUCTOR

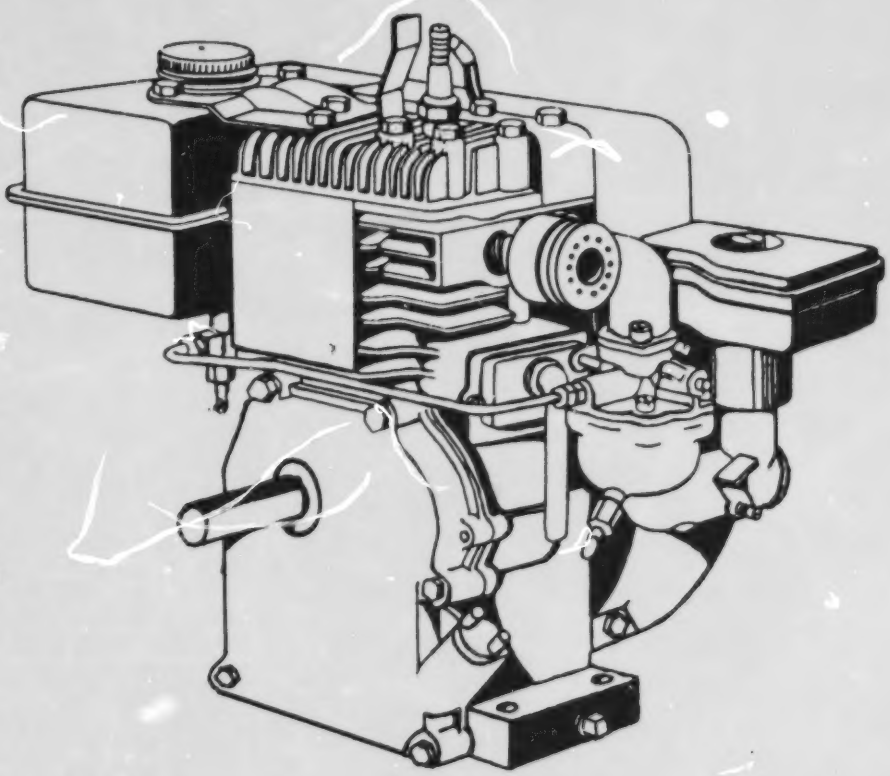
☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

TURN THE PAGE AND BEGIN

Unit 4
Small Engine Parts and Their Use

Introduction

Small engines are made of many parts. In order for you to work on small engines you must be able to identify and know the use of these parts. In this lesson you will learn to identify small engine parts and know their use.



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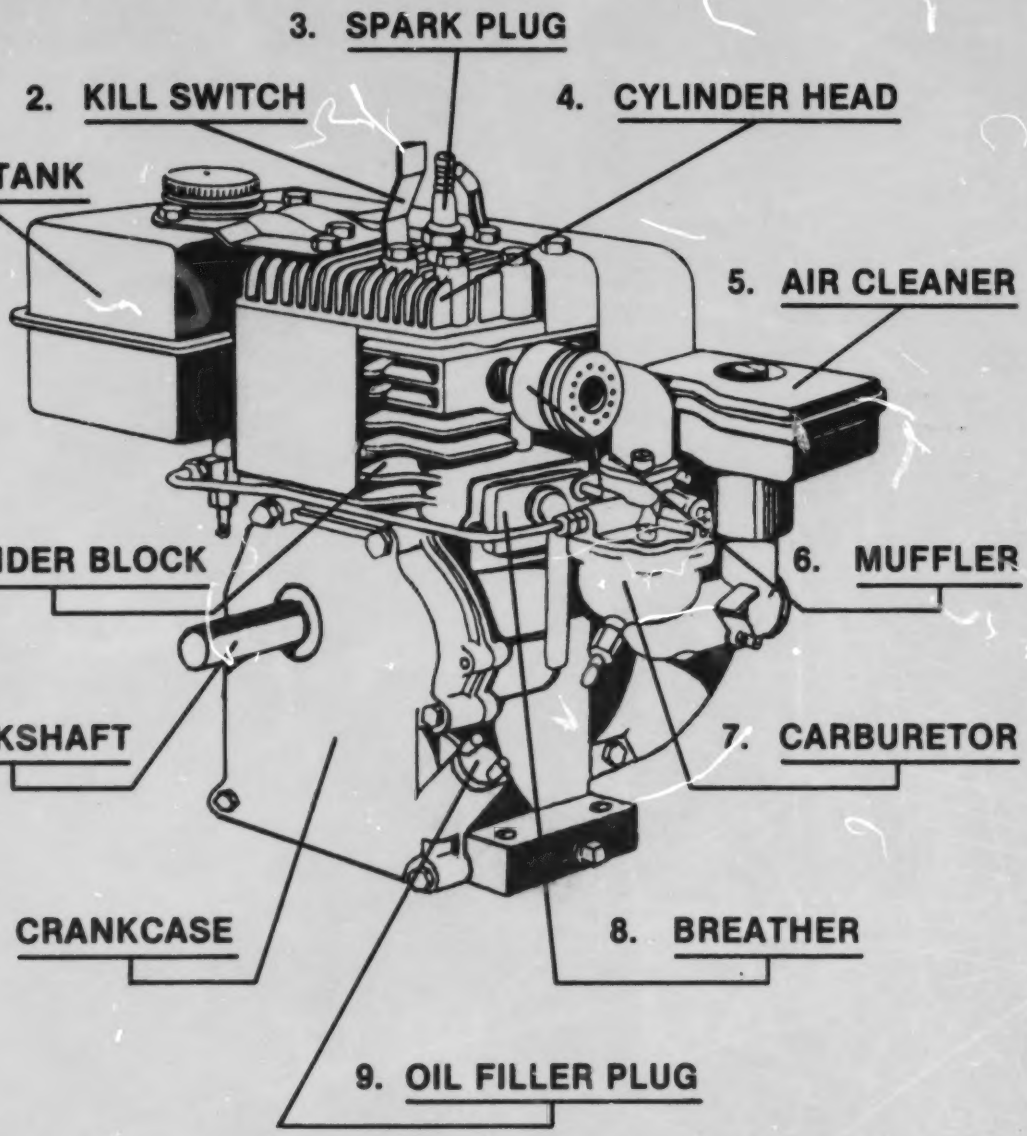
Unit 4
Small Engine Parts and Their Use

A. Small Engine Parts.

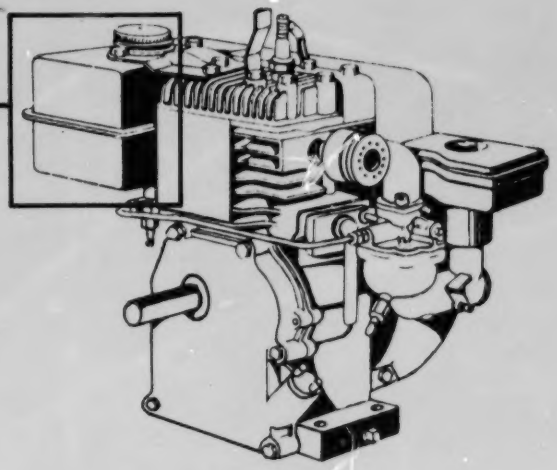


NOTE!

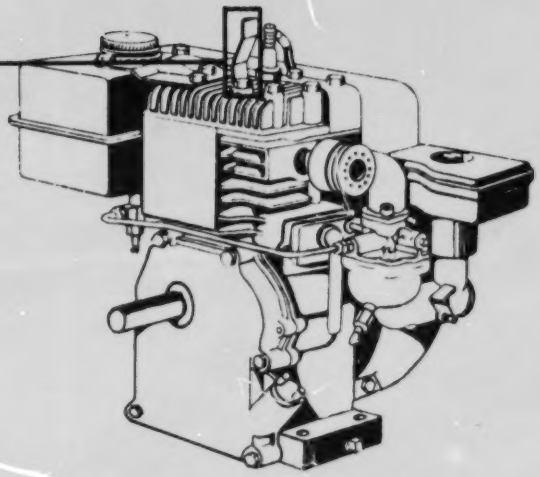
Take time to go over various parts of the engine. Try to understand functions of each part. If you have problems understanding parts, talk to your instructor.

B. Small Engine Parts and their Functions.

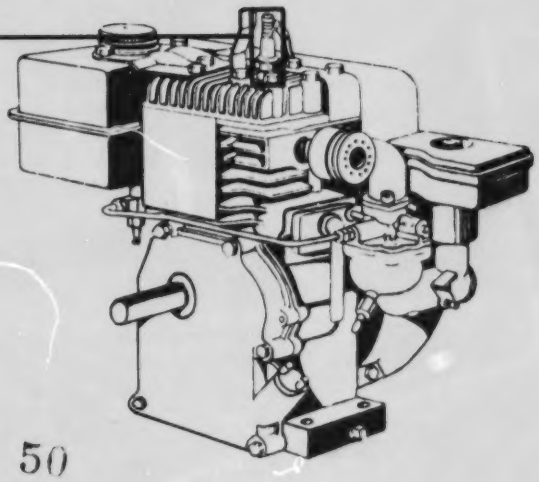
1. **FUEL TANK:** Container for gasoline.



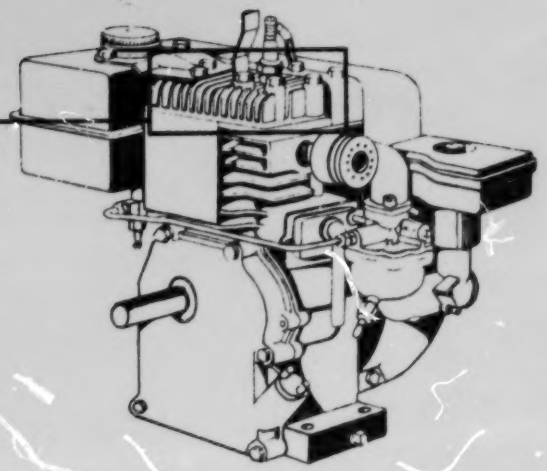
2. **KILL SWITCH:** Metal part used to stop engine.



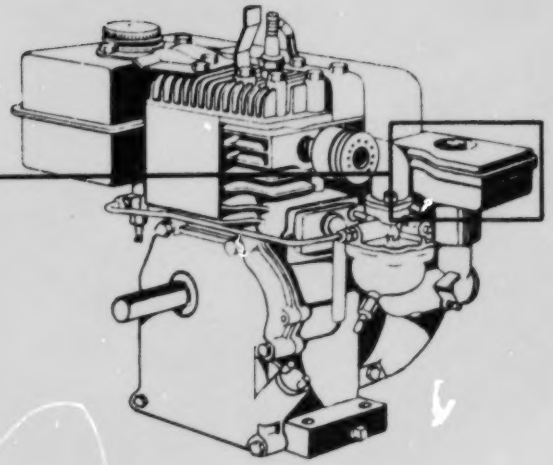
3. **SPARK PLUG:** Produces a spark to ignite air and fuel from carburetor.



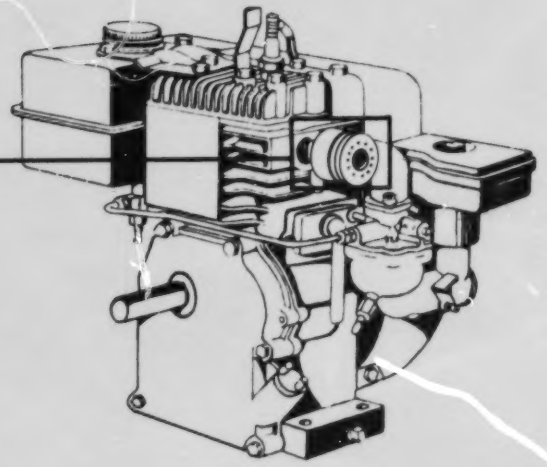
4. **CYLINDER HEAD:** Contains spark plug and cylinder.



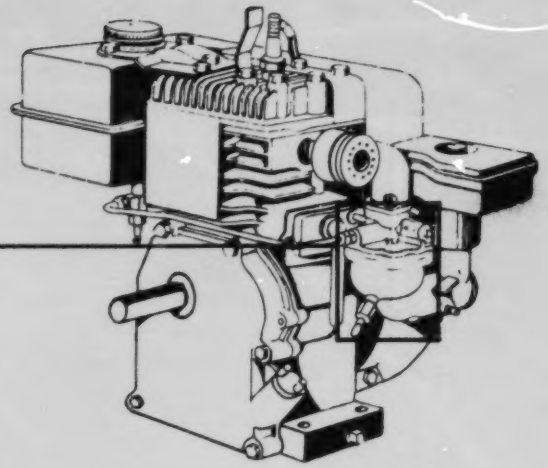
5. **AIR CLEANER:** Filter that cleans air before it enters carburetor.



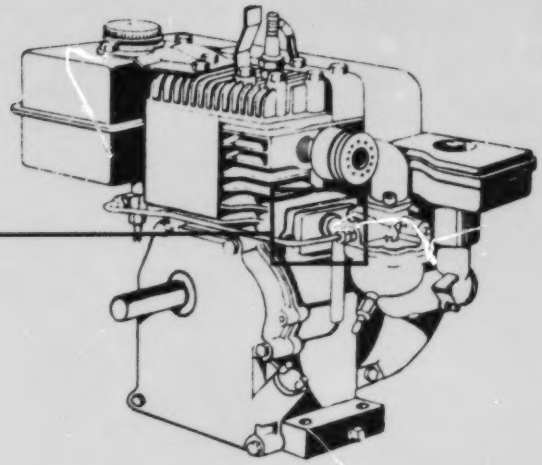
6. **MUFFLER:** Used to reduce engine noise.



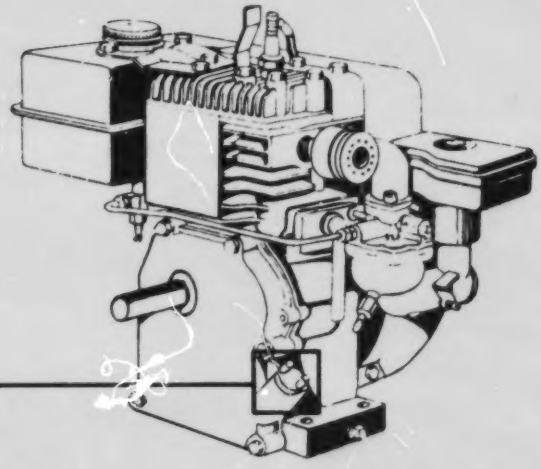
7. **CARBURETOR:** Mixes air and fuel in correct amount to burn in engine.



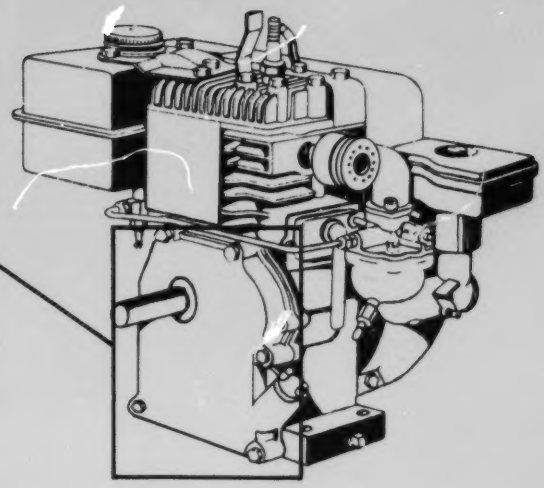
8. **BREATHER:** Device used to maintain a vacuum in crankcase.



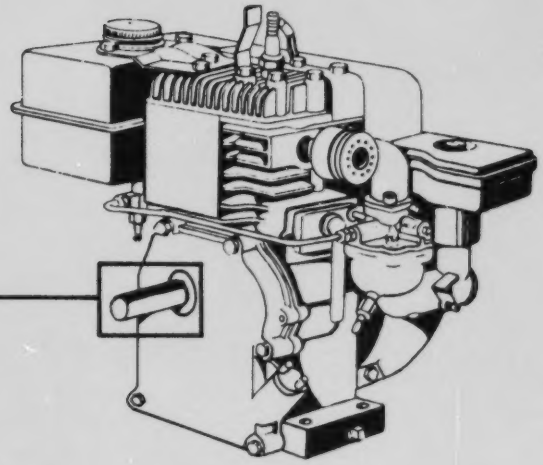
9. **OIL FILLER PLUG:** Plug that covers hole where oil is added to crankcase.



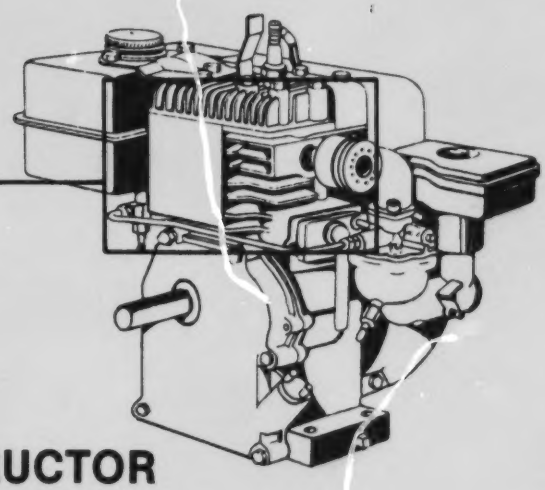
10. **CRANKCASE:** Supports the crankshaft.



11. **CRANKSHAFT:** An offset shaft to which piston and connecting rod are attached.



12. **CYLINDER BLOCK:** Largest part of an engine which contains the cylinder.



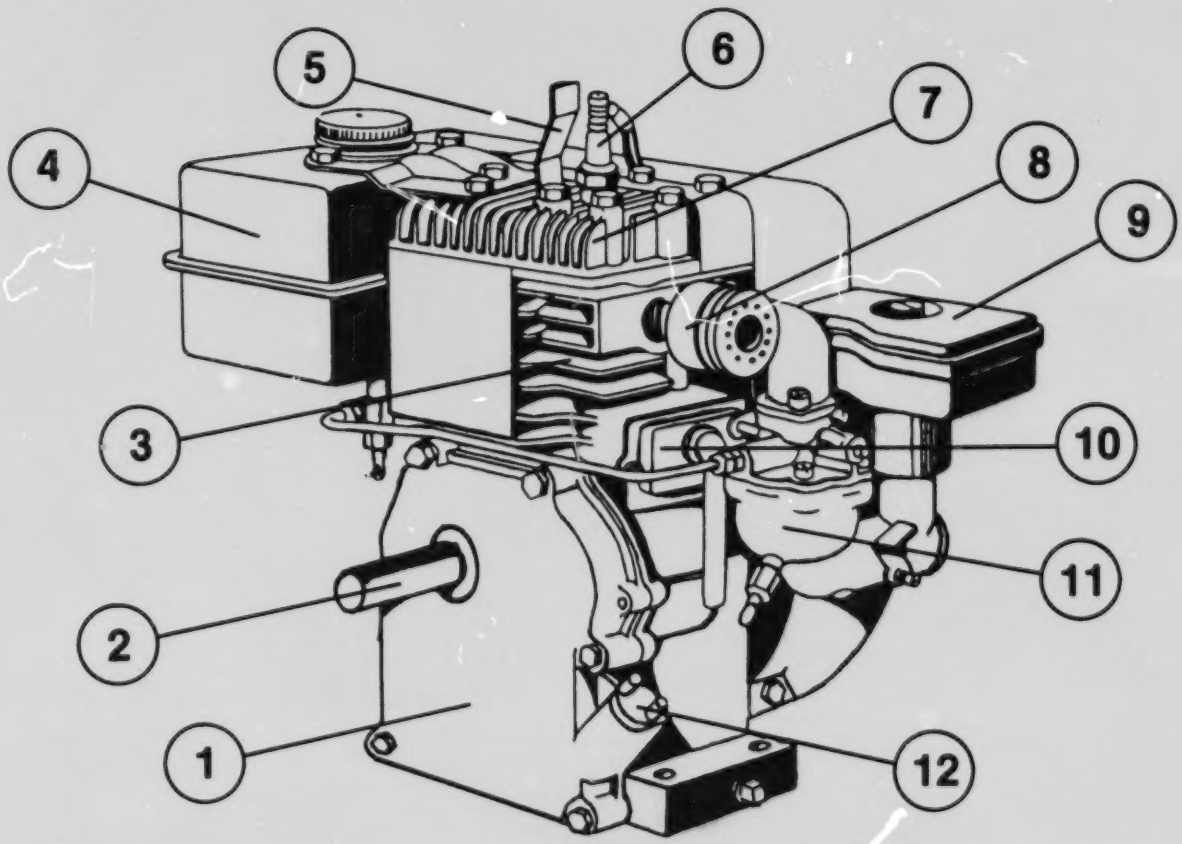
SEE YOUR INSTRUCTOR

Unit 4
Small Engine Parts and Their Use

C. Small Engine Parts Identification Exercise.

Match the following parts with its correct name.

___ A. Fuel Tank
___ B. Crankshaft
___ C. Oil Filler Plug
___ D. Spark Plug
___ E. Crankcase
___ F. Cylinder Block
___ G. Cylinder Head
___ H. Air Cleaner
___ I. Carburetor
___ J. Breather
___ K. Muffler
___ L. Kill Switch

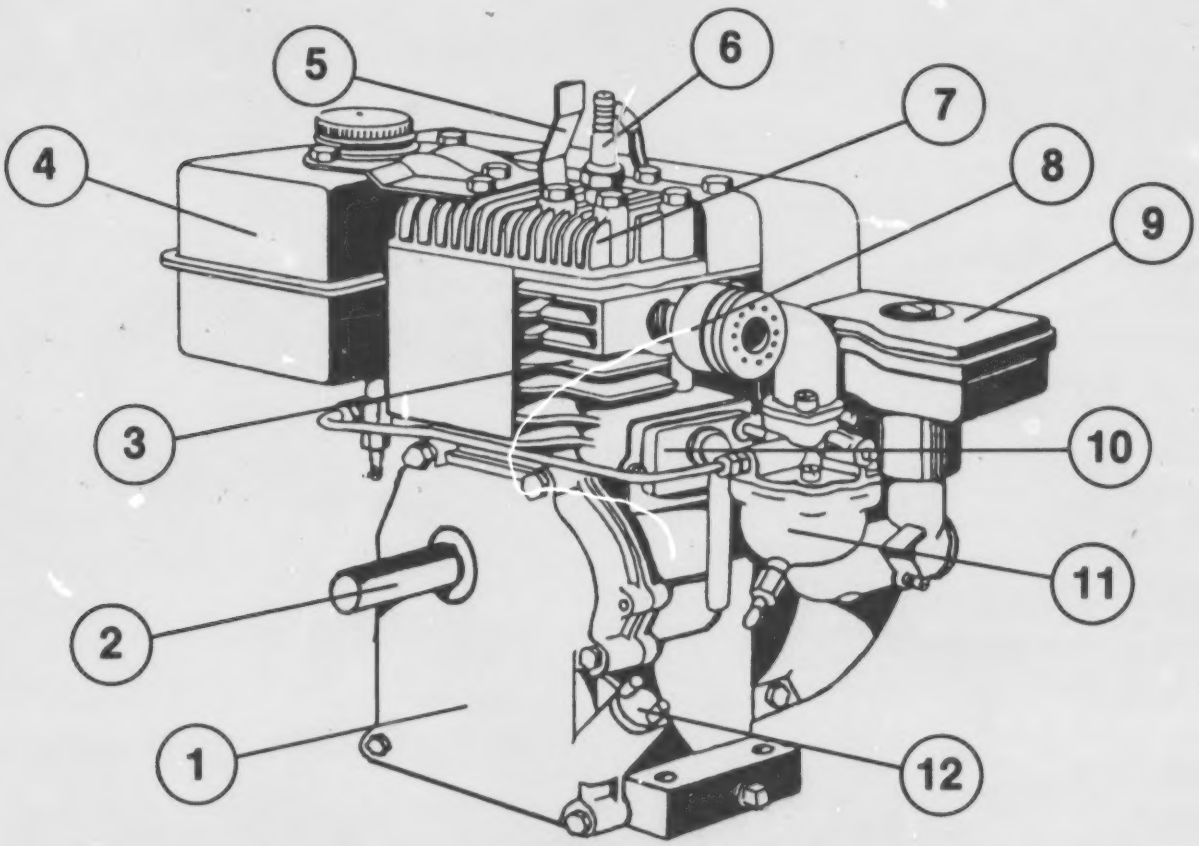


Unit 4
Small Engine Parts and Their Use

D. Small Engine Parts Identification Exercise.

Match each part with its correct use.

___A. Storage for gasoline
___B. Produces spark to ignite air and fuel from carburetor
___C. Engine part containing spark plug
___D. Filter that cleans air before it enters carburetor
___E. Correctly mixes air and fuel to burn in engine
___F. Covers hole where oil is added to crankcase
___G. Supports crankcase
___H. Offset shaft in which piston and connecting rod are attached
___I. Largest part of engine which contains cylinder
___J. Maintains a vacuum in crankcase
___K. Reduces engine noise
___L. Metal part used to stop engine



Unit 4
Small Engine Parts and Their Use

Practical Exercise Performance Checklist

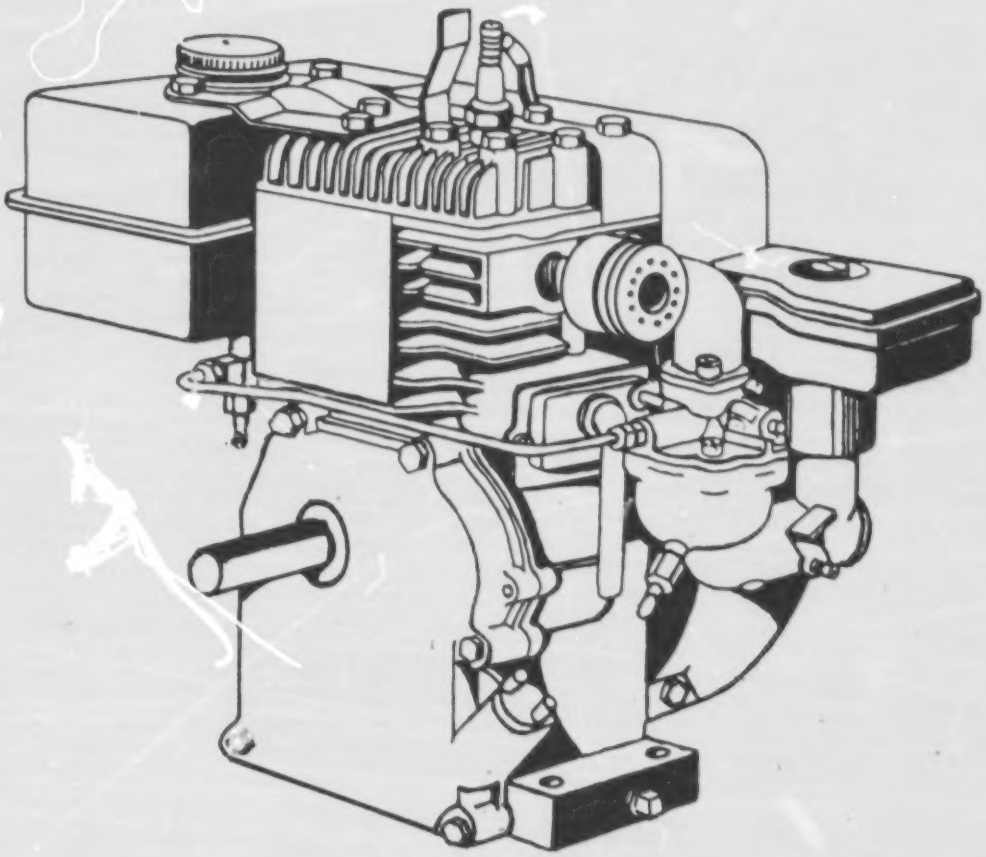
The student_____successfully performed the following tasks:

Tasks	Yes	No	Comments
Identified part and its use:			
a. Fuel tank			
b. Air cleaner			
c. Carburetor			
d. Spark plug			
e. Cylinder head			
f. Crankcase			
g. Crankshaft			
h. Oil filler plug			
i. Cylinder block			
j. Breather			
k. Muffler			
l. Kill switch			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 5

Fuel Selection and Use 2-Cycle

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Unit 5
Fuel Selection and Use - 2-Cycle

Fuel Selection and Use - 2-Cycle

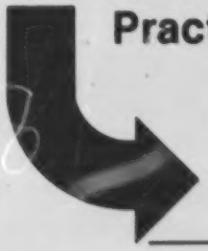
After you study this lesson, you should be able to:

1. Identify tools and materials used in refueling small engines.
2. Refuel a 2-cycle small engine safely.

Show What You Can Do.

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**



SEE YOUR INSTRUCTOR

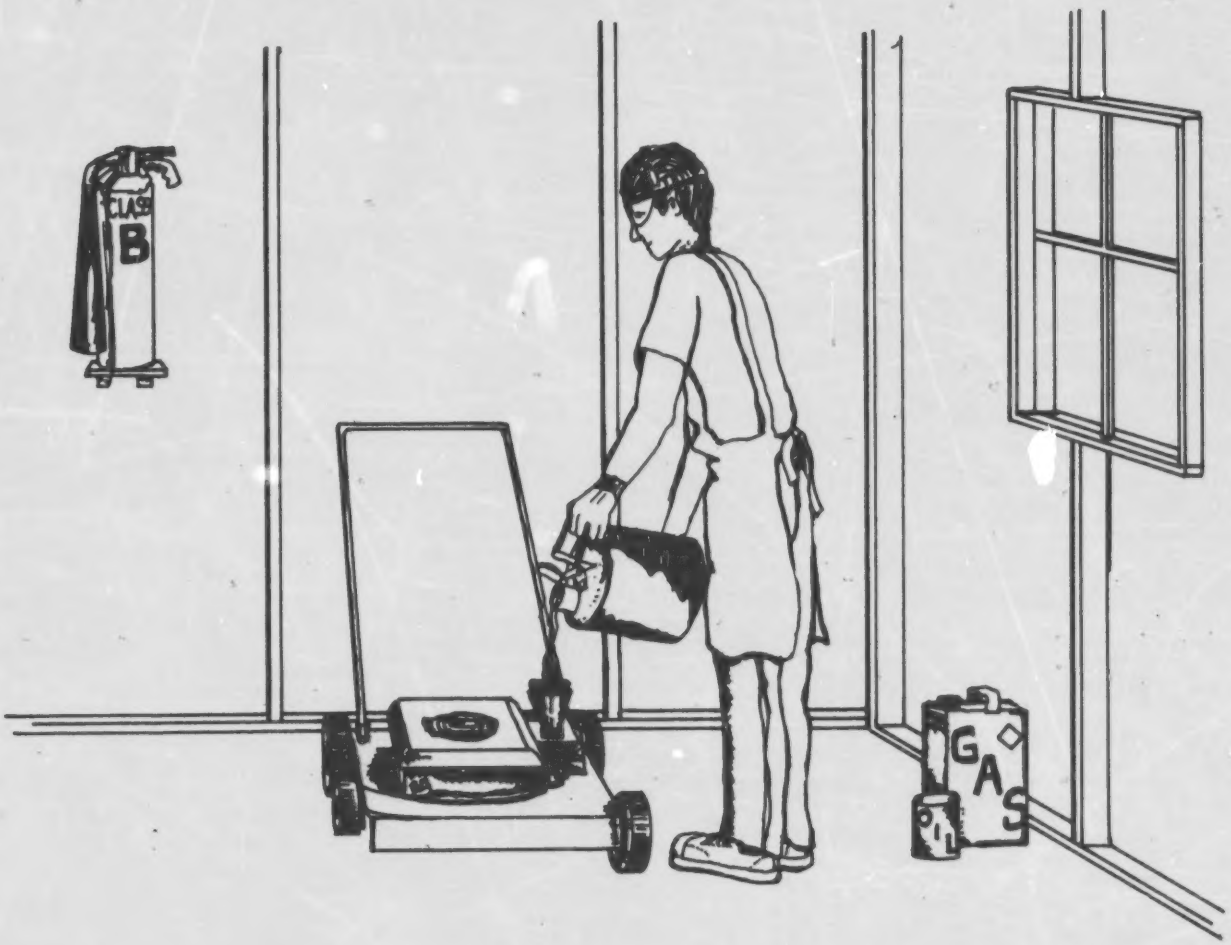
☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

TURN THE PAGE AND BEGIN

Unit 5
Fuel Selection and Use - 2-Cycle

Introduction

In this unit you will study how to safely fuel a small engine. You will also learn about equipment needed and storage of fuel. Follow safety rules, a few minutes of time saved by a dangerous shortcut is never worth the price of an accident.



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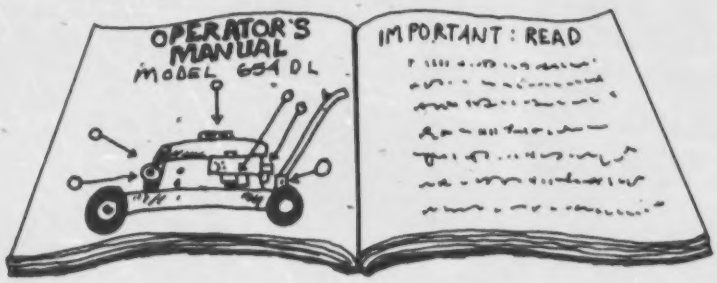
Unit 5
Fuel Selection and Use - 2-Cycle

A. Tools, Materials and Equipment for Fuel Selection and Use - 2-Cycle.

1. **FUNNEL AND STRAINER:** Used to filter and pour gasoline into small engine tank.

2. **OPERATOR'S MANUAL:** Used to look up detailed information about specific small engine.



3. **FIRE EXTINGUISHER:** Used to put out fires that may occur in a workshop.

60

4. **GASOLINE:** Fuel used in a small engine.

5. **OIL:** Lubricant used to prolong life of small engine's moving parts.

6. **SAFETY EQUIPMENT:** Worn to protect face and clothes

7. **SHOP TOWELS:** Used to clean or wipe dirt or spilled gasoline from small engines.

TURN TO NEXT PAGE

B. Steps for Refueling a 2-Cycle Small Gasoline Engine:

1. Find and Check Off the following:

☐ Funnel and Strainer

☐ Operator's Manual

☐ Fire Extinguisher

☐ Gasoline

☐ 2-cycle Oil

☐ Shop Towels

☐ Safety Equip.

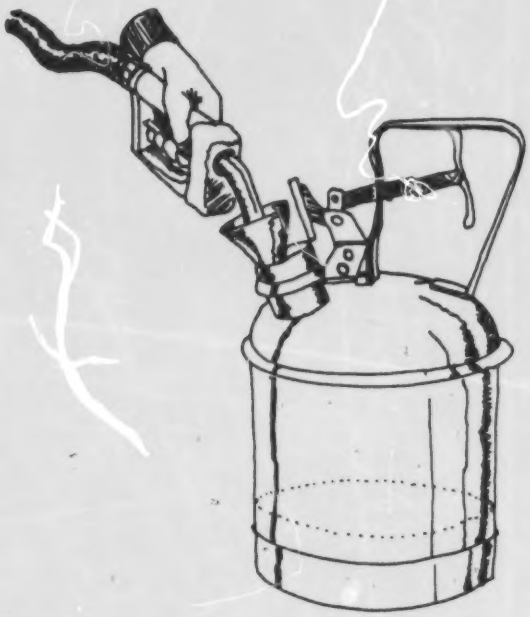
2. Always wear proper safety equipment.

3. Obtain an approved gas can.

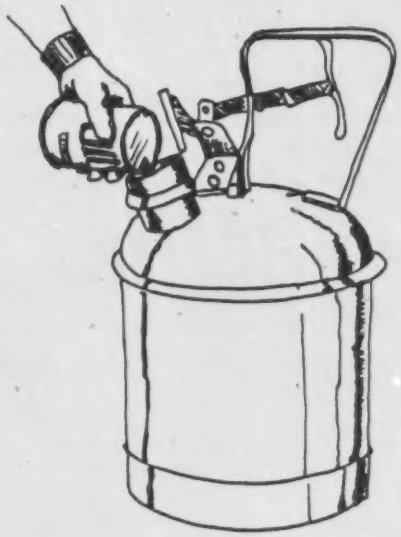
NOTE!

Can should be big enough to contain two times the quantity of gas you want to mix.

4. Fill container ¼ full of fuel. Strain fuel to remove any trash or dirt.



5. Add correct amount of oil to gasoline.



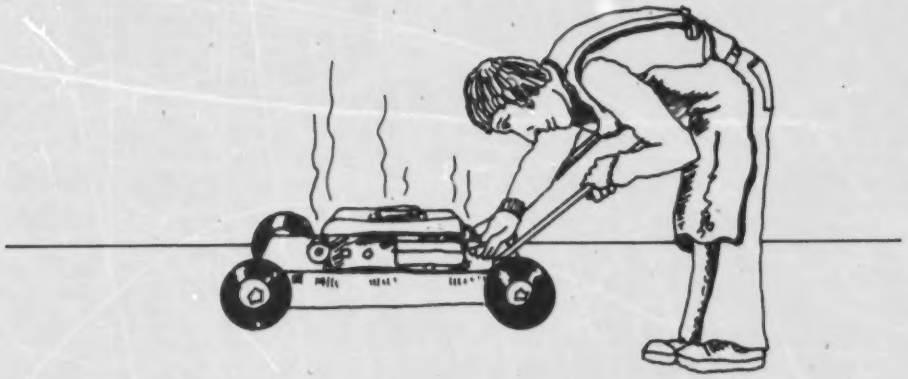
NOTE!

The ratio of oil to gas varies with different engines. Read your operator's manual and follow the manufacturer's directions.

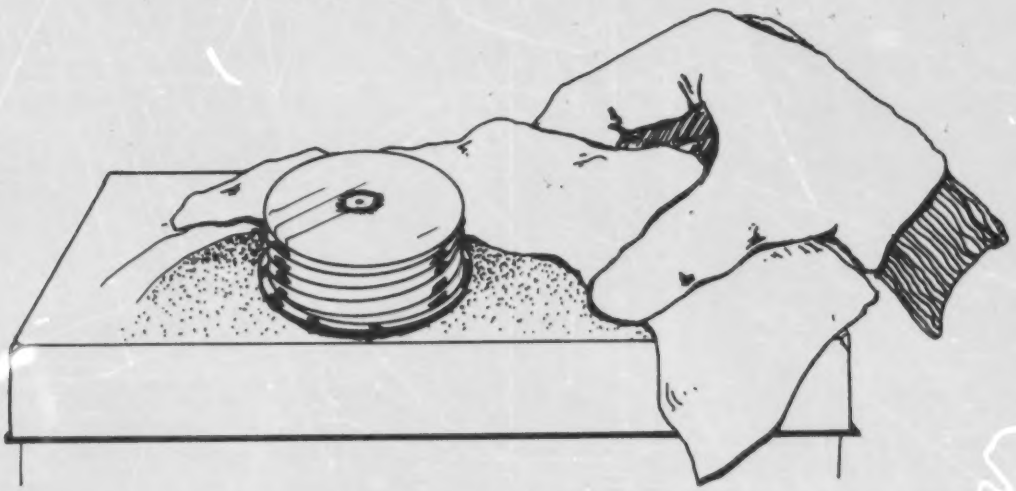
6. Shake can vigorously and add more gasoline until container is one half full.

Shake container until oil and gas mix properly.

7. Stop engine if it is running. Allow it time to cool .



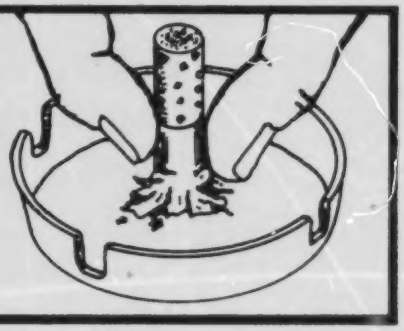
8. Locate gas tank filler cap. Wipe dust and dirt from filler cap on fuel tank with a shop towel.



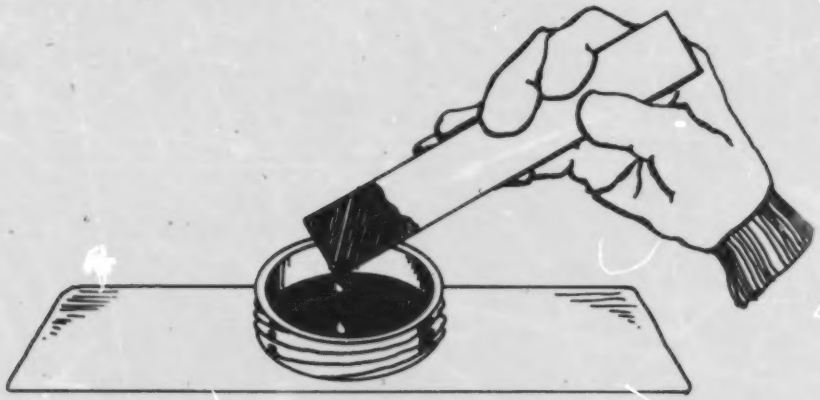
9. Remove filler cap.

CAUTION!

Do not smoke or light a match near open fuel tank.

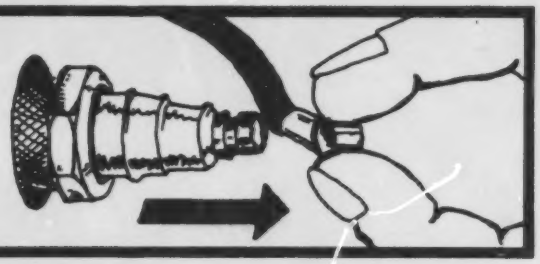


10. Check fuel level in tank. Refill it if necessary.



CAUTION!

Always stop engine when adding fuel.



NOTE!

Never use the last few drops from a gasoline can. Water and dirt are likely to be present.

If fuel is accidentally spilled, wipe it away with a shop towel.

11. Replace fuel tank filler cap securely.

12. Store remaining gasoline safely.

SEE YOUR INSTRUCTOR

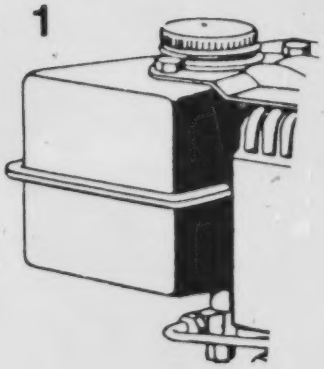
Unit 5
Fuel Selection and Use - 2-Cycle

Tools and Materials Identification Exercise

Match each object with its correct name.

____ A. Fire extinguisher
____ B. Funnel and strainer
____ C. Operator's manual
____ D. 2-cycle engine oil
____ E. Gasoline container
____ F. Small engine gas tank

1



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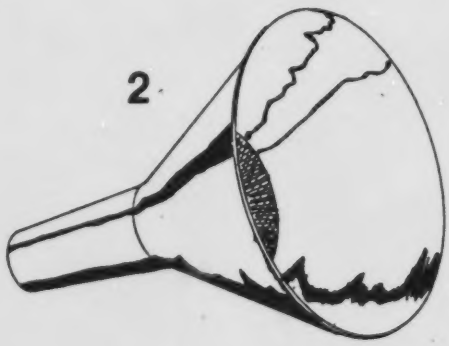

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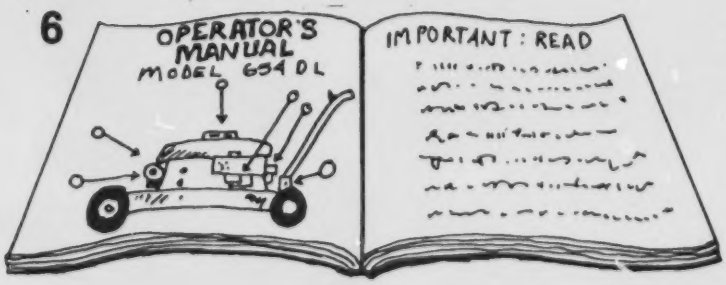


Unit 5
Fuel Selection and Use - 2-Cycle

Practical Exercise Performance Checklist

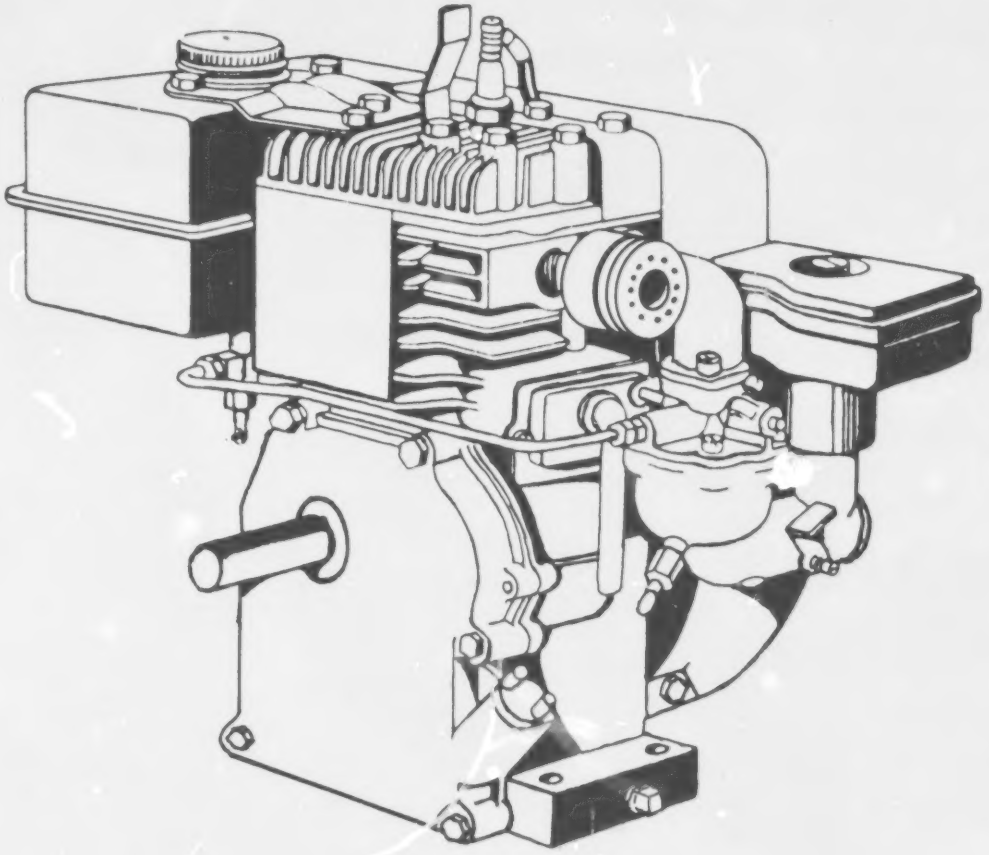
The student _____ successfully performed the following tasks:

Tasks	Yes	No	Comments
1. Identified:			
a. Funnel and strainer			
b. Operator's manual			
c. Fire extinguisher			
d. Engine oil (2-cycle)			
e. Gasoline container			
2. Wore proper safety equipment			
3. Obtained proper can for mixing			
4. Properly strained gasoline into container until ¼ full			
5. Correctly used operator's manual to select and add oil			
6. Shook can properly and added more gasoline until container was one half full.			
7. Closed container tightly and shook it.			
8. Stopped engine and allowed it to cool			
9. Located and cleaned filler cap			
10. Safely removed filler cap			
11. Checked fuel level in tank and refueled as necessary			
12. Safely handled spilled gasoline			
13. Replaced fuel tank filler cap tightly			
14. Stored remaining gasoline and cleaned work area.			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 6

Inspecting and Servicing the Spark Plug

PRACTICAL ARTS AND VOCATIONAL-TECHNICAL EDUCATION

IML

INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 6
Inspecting and Servicing the Spark Plug

Inspecting and Servicing the Spark Plug

After you study this lesson, you should be able to:

1. Identify tools and materials used in inspecting and servicing the spark plug.
2. Inspect and service the spark plug.

Show What You Can Do

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

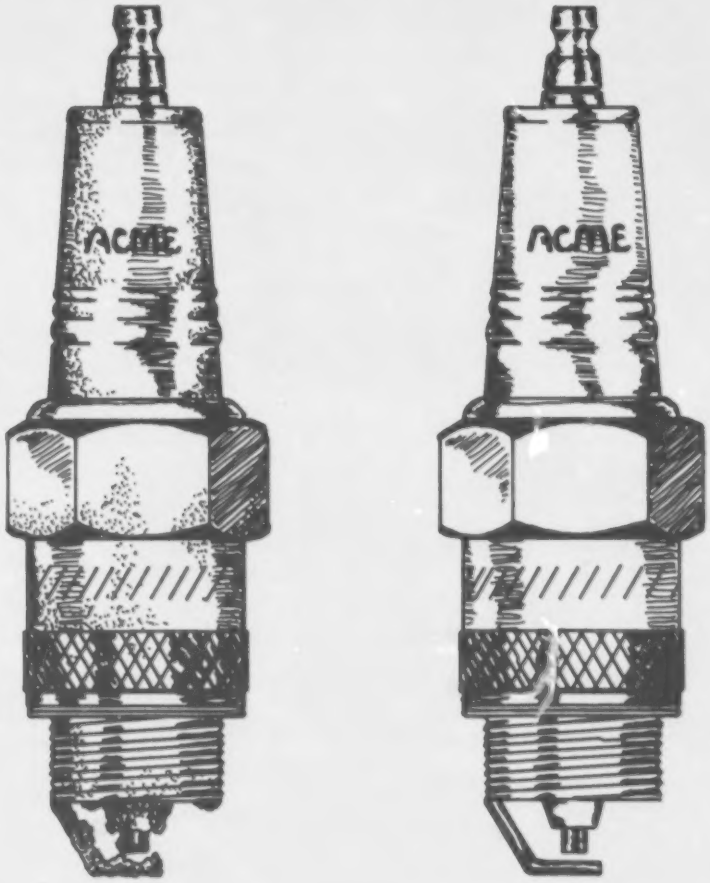
☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

TURN THE PAGE AND BEGIN

Unit 6
Inspecting and Servicing the Spark Plug

Introduction

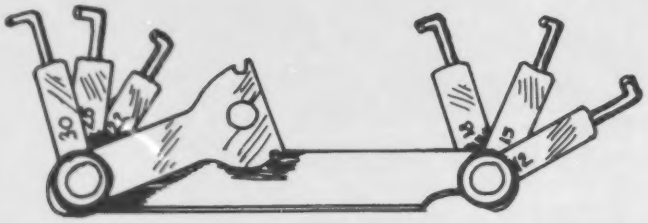
You are ready to learn how to inspect and service the spark plug. When should the spark plug be cleaned? Small engine manufacturers recommend that you should remove, inspect, clean and regap a spark plug after every 100 hours of engine operation. Always follow the recommendations if you want the small engine to do the job.



BEFORE AFTER

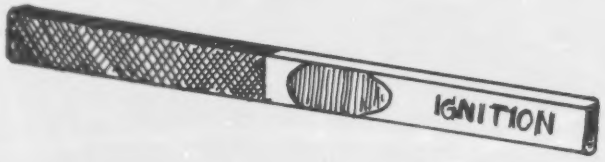
TURN TO NEXT PAGE

4. **WIRE FEELER GAUGES OR GAP SETTER:** Used to check gap of a spark plug.

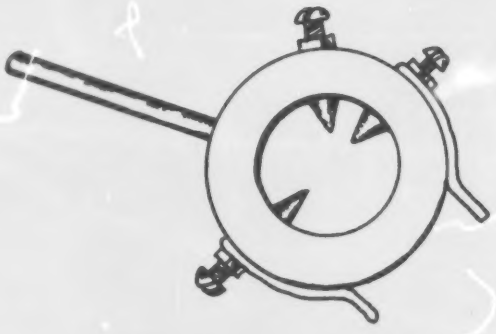


5. **WIRE BRUSH:** Used to clean spark plug.

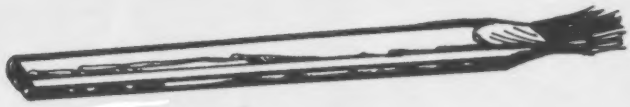
6. **IGNITION FILE:** Used to file ground and central electrode of the spark plug.



7. **SPARK TESTER:** Used to check the spark of the ignition system.

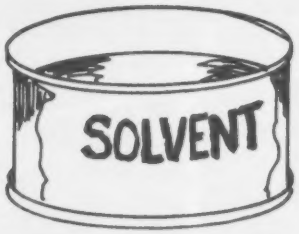


8. **CLEANER BRUSH:** Used to brush away dirt before removing the spark plug.



9. **PEN KNIFE:** Used to remove deposits from inside wall of spark plug.

10. **SMALL PAN AND SOLVENT:** Used for cleaning the spark plug.



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B. Steps in Inspecting and Servicing the Spark Plug.

1. Find and Check Off the following:

☐ Spark Plug Socket

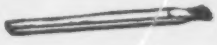
☐ Socket Wrench

☐ Feeler Gauge

☐ Wire Brush

☐ Ignition File

☐ Spark Tester



☐ Cleaner Brush

☐ Knife

☐ Small Pan and Solvent

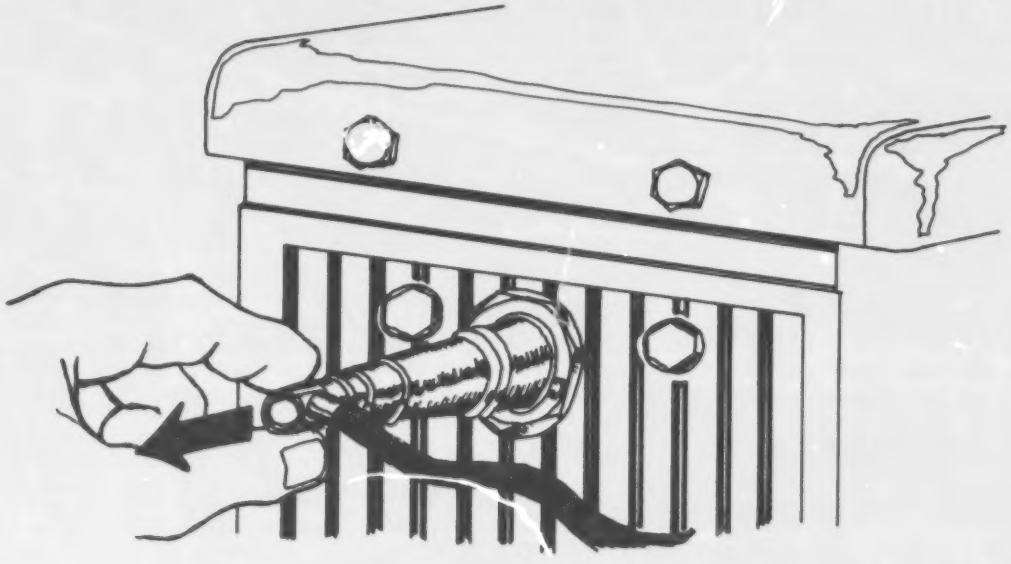
☐ Safety Equip.

2. Put on proper safety equipment.

CAUTION!

Before beginning any work on an engine, pull the spark plug wire.

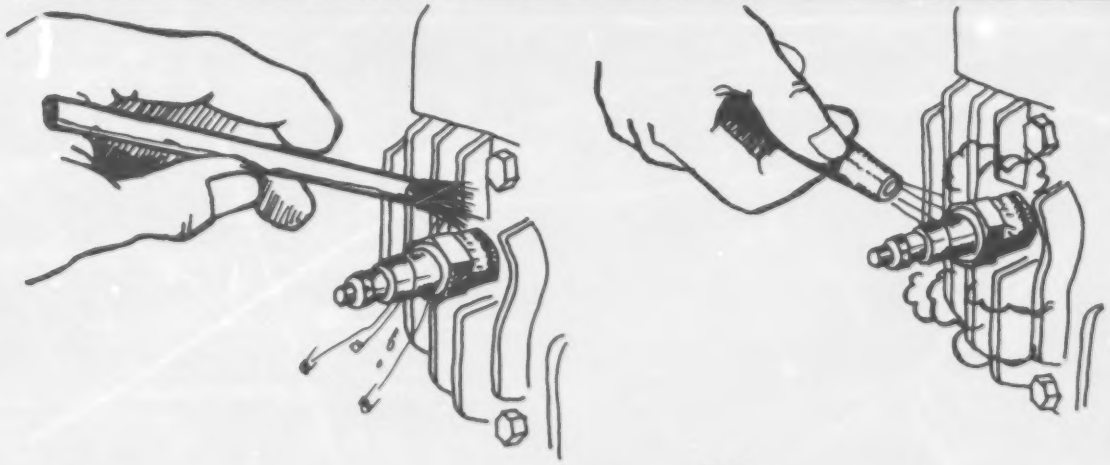
3. Find the spark plug on the cylinder head and disconnect the wire.



4. Brush away dirt around spark plug and cylinder head.

NOTE!

After brushing away the dirt, use an air hose.

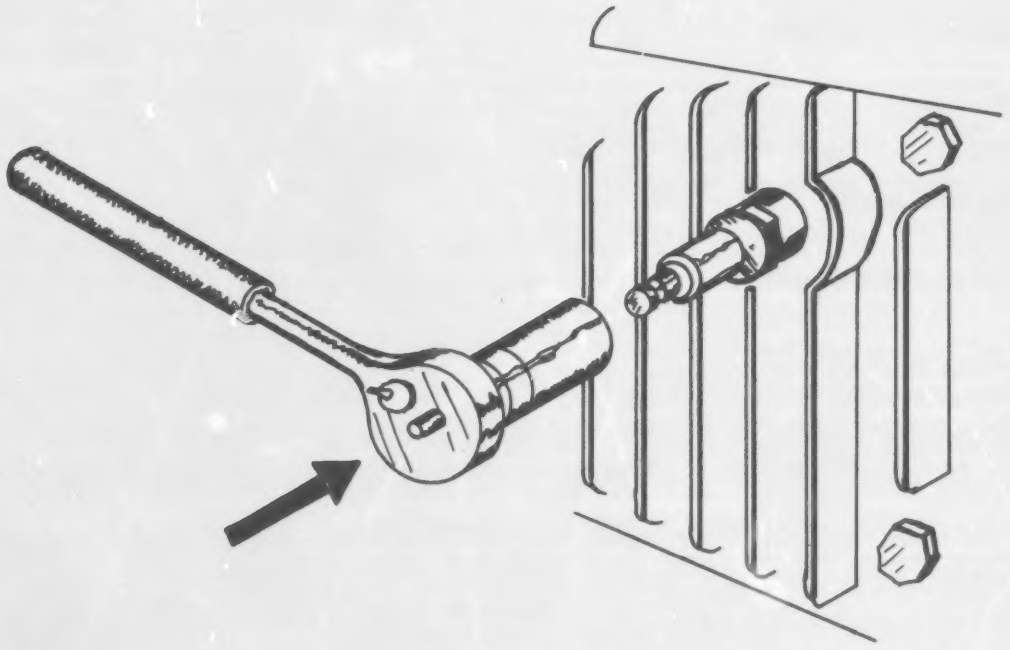


5. Place spark plug socket on socket wrench.

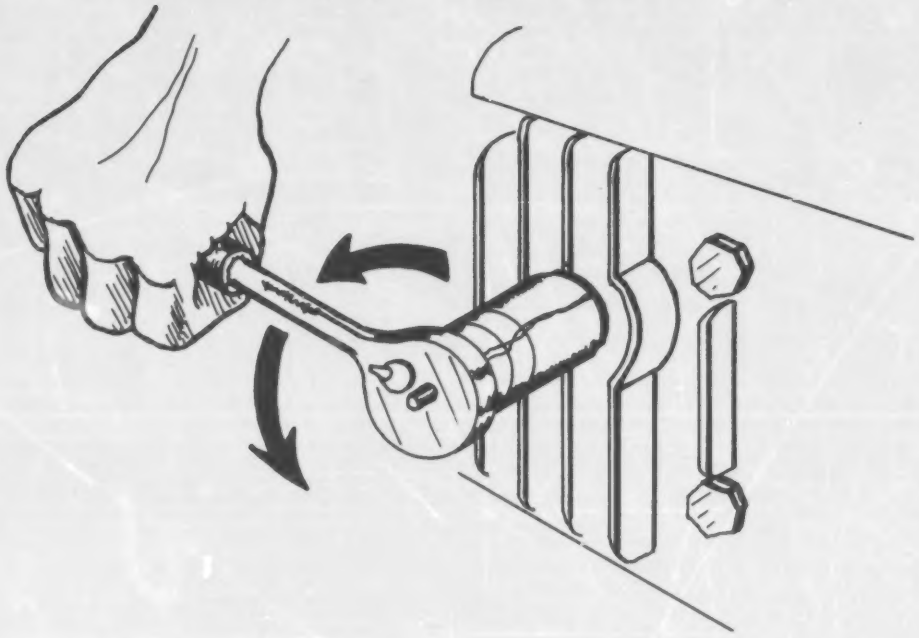
NOTE!

Always use a spark plug socket for taking out and putting back spark plugs.

6. Place socket wrench straight over spark plug.

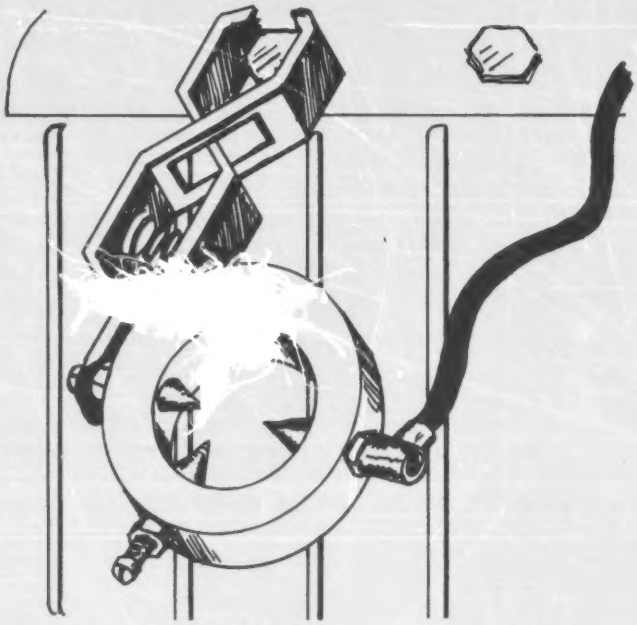


7. Remove spark plug by turning socket wrench to the left.

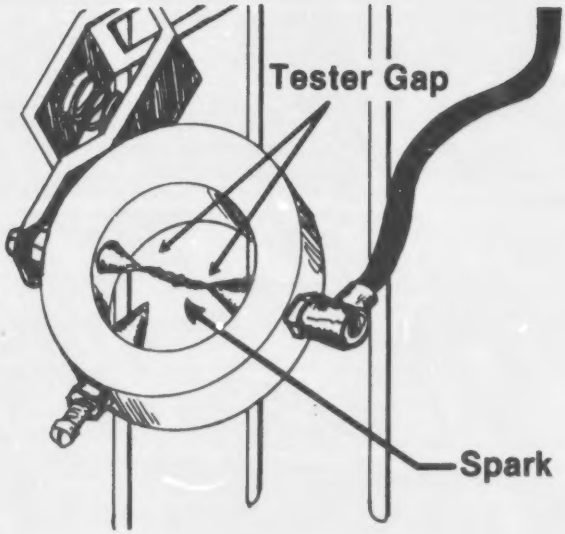


8. Remove the spark plug and set it aside.

9. Place metal connector of spark plug wire on spark plug tester. Clip other end of tester to unpainted part of cylinder head.



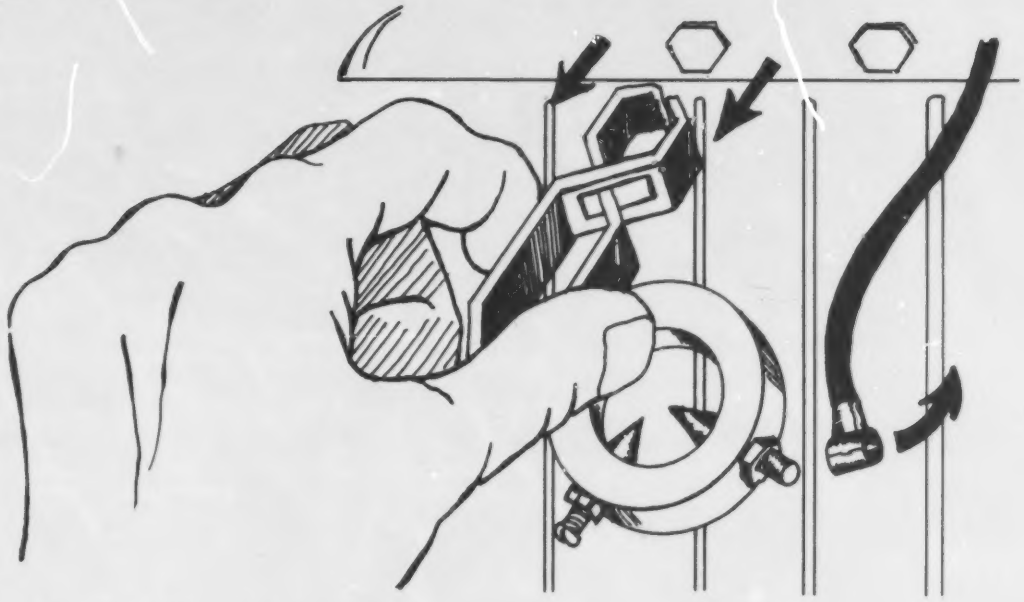
10. Crank the engine.



NOTE!

If spark jumps the tester gap, you can assume ignition system is OK.

11. Remove spark tester from engine.



12. Service the spark plug.

NOTE!

Usually you will replace a fouled or burned spark plug. You do need to know how to service an old plug.

13. Brush threads of spark plug.

NOTE!

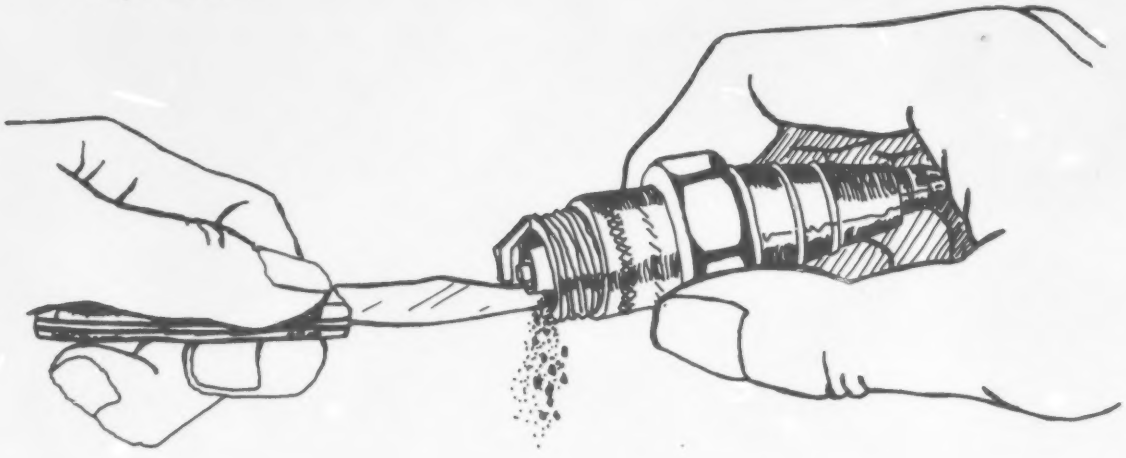
Do not wire brush the insulator. This will cause a film to build up and will cause an electrical short.

CAUTION:

Use your safety glasses.

Brush away from your body.

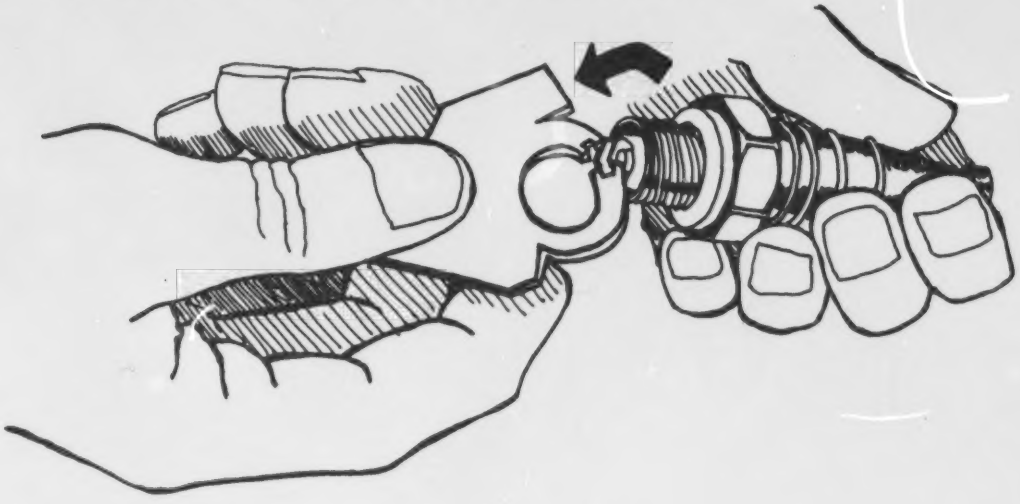
14. Scrape deposits from inside wall of plug and blow out loose deposits.



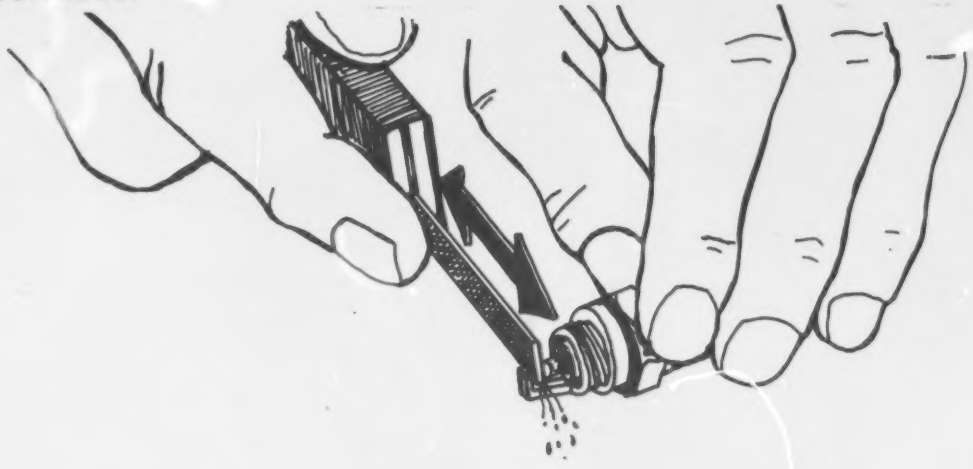
NOTE!

When scraping inside wall of plug, be careful not to damage the porcelain or bend the central electrode.

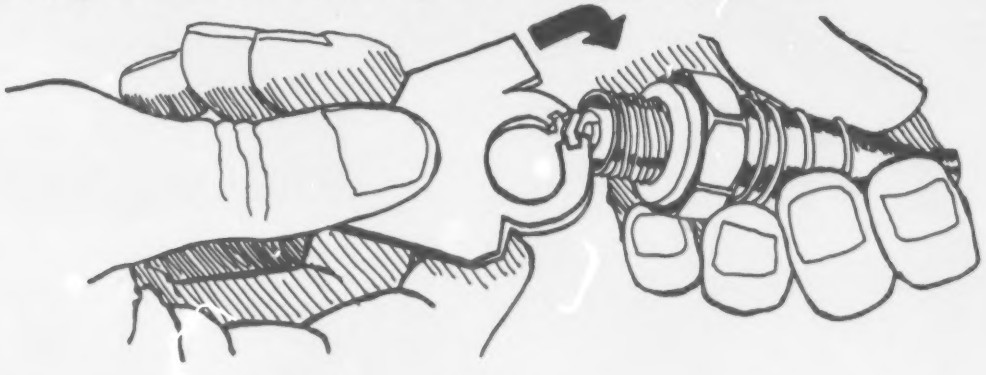
15. Bend ground electrode away from central electrode to allow ignition file to fit between the two electrodes.



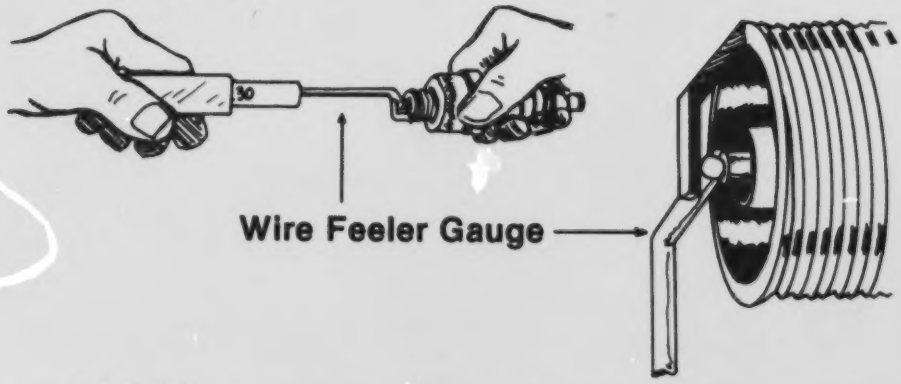
16. File ground and central electrode until both have flat, shiny surfaces.



17. Bend ground electrode back to its original position.

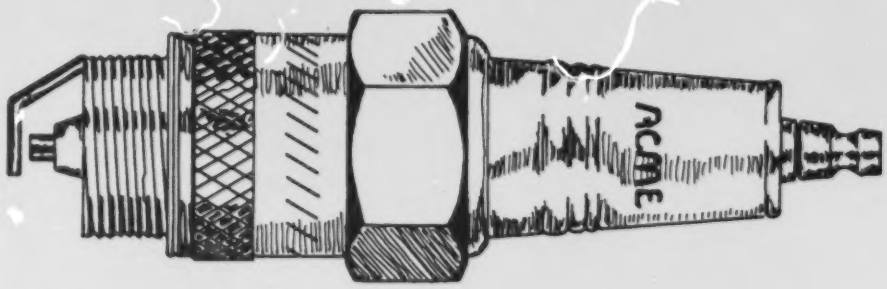


18. Check the gap size.



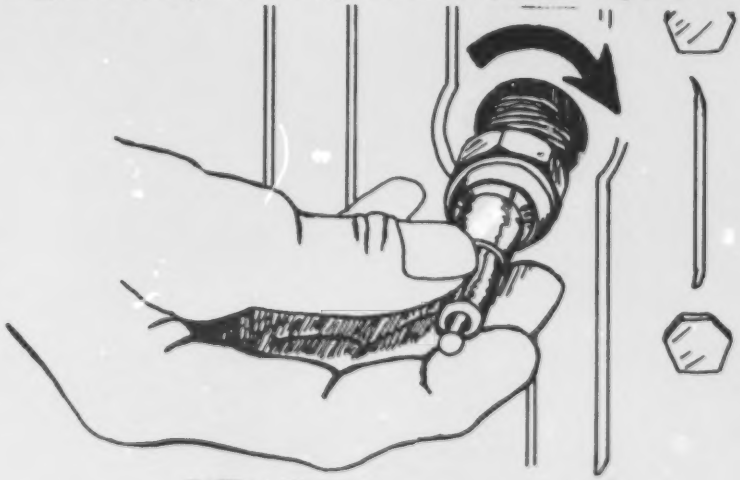
NOTE!

Check manual for correct spark plug gap size.



A properly serviced spark plug should look like this.

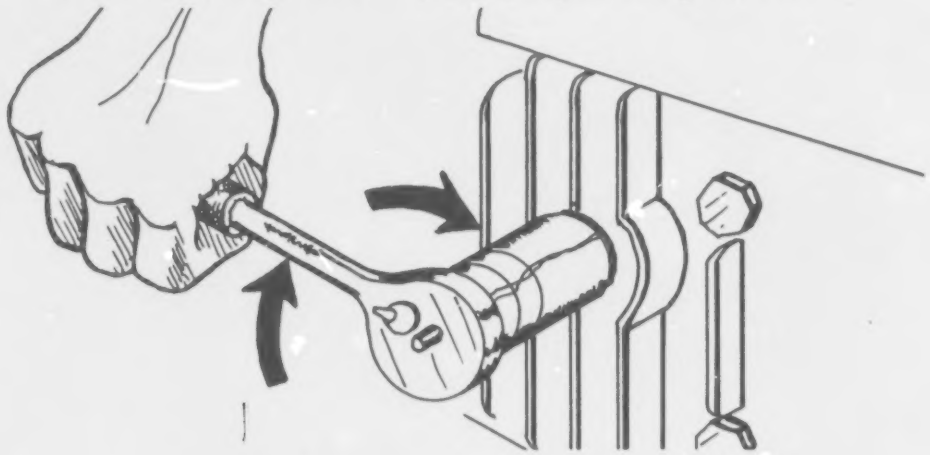
19. Screw serviced spark plug into engine with your fingers.



NOTE!

Screwing in a spark plug too loose or too tight may cause damage to it.

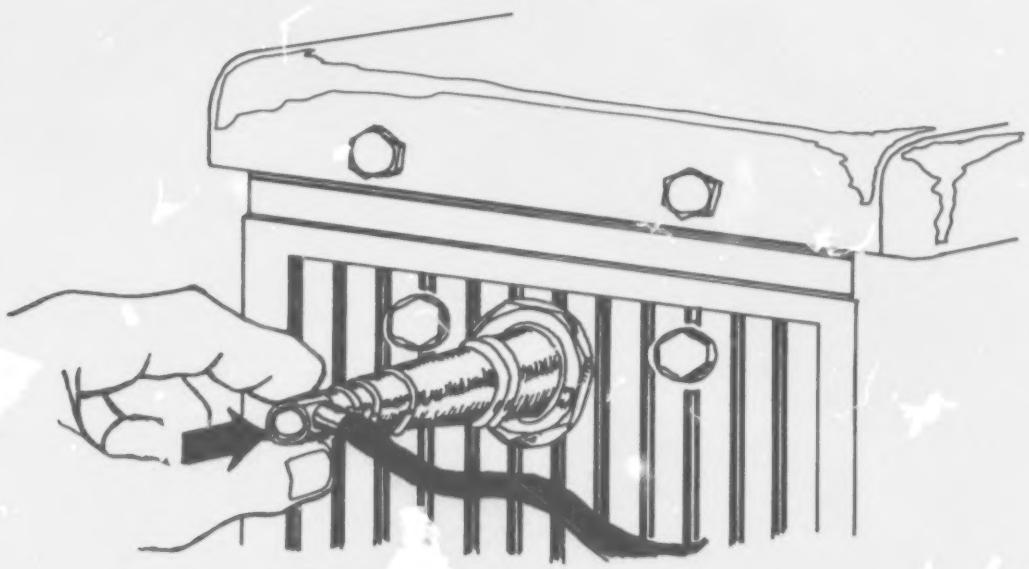
20. Place socket wrench on spark plug and tighten it.



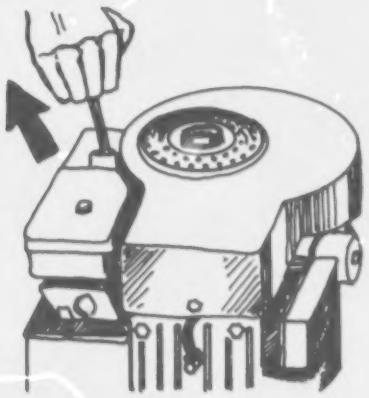
CAUTION!

Check with your instructor before starting engine. Make sure area under and around engine is clear.

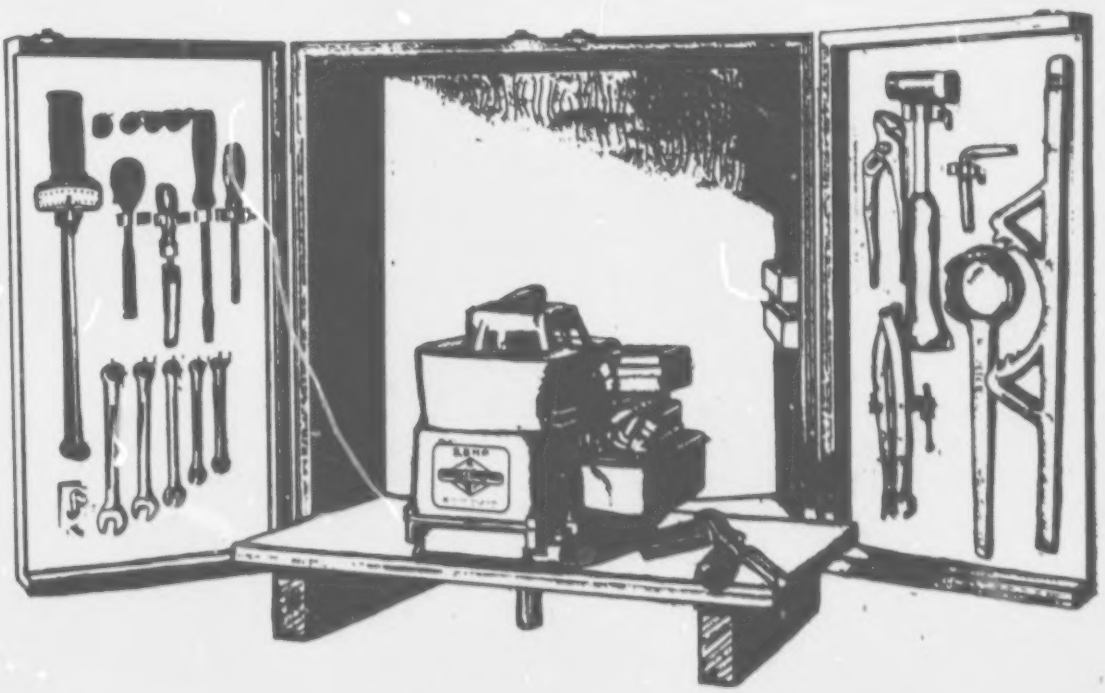
21. Reconnect spark plug wire to spark plug.



22. Start engine and see if it runs properly.



23. Clean your work area and return tools to their proper places.



SEE YOUR INSTRUCTOR

Unit 6
Inspecting and Servicing the Spark Plug

Practical Exercise Performance Checklist

The student _____ successfully performed the following tasks:

Tasks	Yes	No	Comments
1. Identified:			
a. Spark plug socket			
b. Socket wrench			
c. Safety equipment			
d. Feeler gauge			
e. Wire brush			
f. Ignition file			
g. Spark tester			
h. Cleaner brush			
i. Knife			
j. Small pan and solvent			
2. Wore proper safety equipment.			
3. Located and disconnected spark plug.			
4. Removed dirt around spark plug and cylinder head.			
5. Used spark plug socket to remove plug.			
6. Correctly used spark tester.			
7. Removed spark tester from engine.			
8. Used wire brush to clean spark plug threads.			
9. Scraped deposits from inside wall of plug and blew out deposits.			
10. Used ignition file to clean plug.			
11. Used gap setter to correctly gap spark plug.			
12. Installed spark plug.			

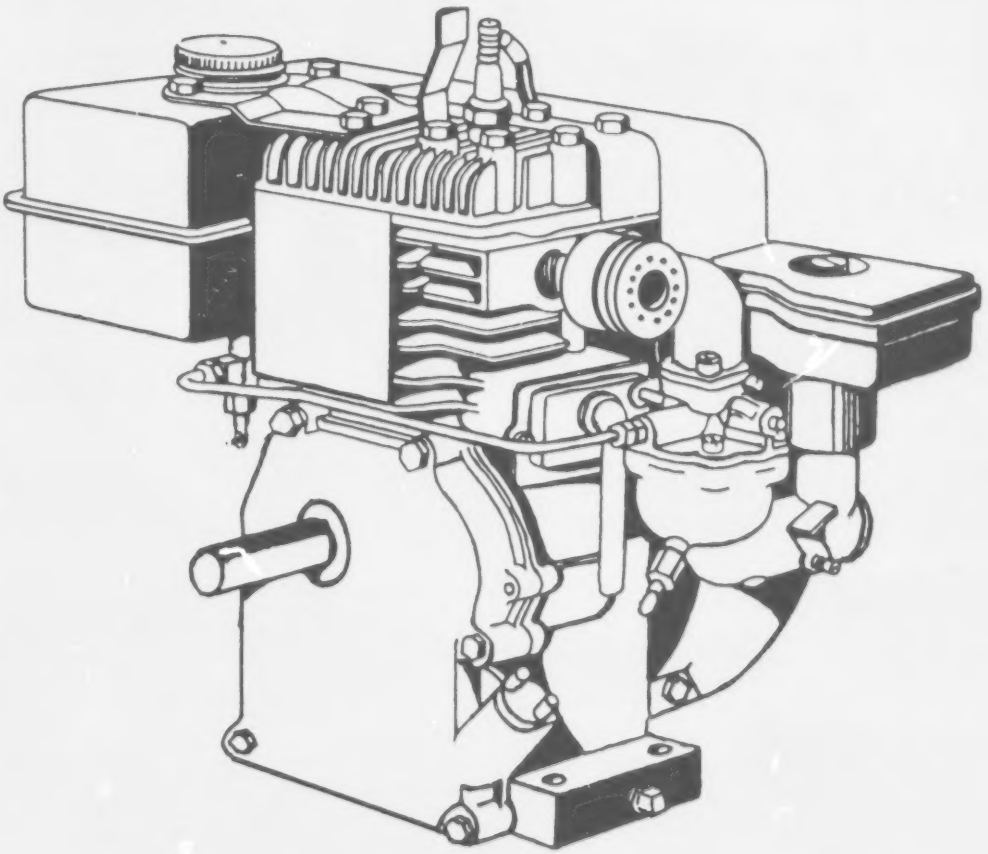
Tasks	Yes	No	Comments
13. Placed metal connector on spark plug.			
14. Checked with instructor before starting engine.			
15. Started engine and saw that it ran properly.			
16. Cleaned work area and returned tools.			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

Vocational Preparation Curriculum

MAINTAINING SMALL ENGINES



Unit 7

Cleaning and Inspecting the Cooling System

PRACTICAL ARTS AND VOCATIONAL-TECHNICAL EDUCATION

IML

INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 7
Cleaning and Inspecting the Cooling System

Cleaning and Inspecting the Cooling System

After you study this lesson, you should be able to:

1. Identify tools and materials used in cleaning and inspecting the small engine cooling system.
2. Clean and inspect the small engine cooling system.

Show What You Can Do

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

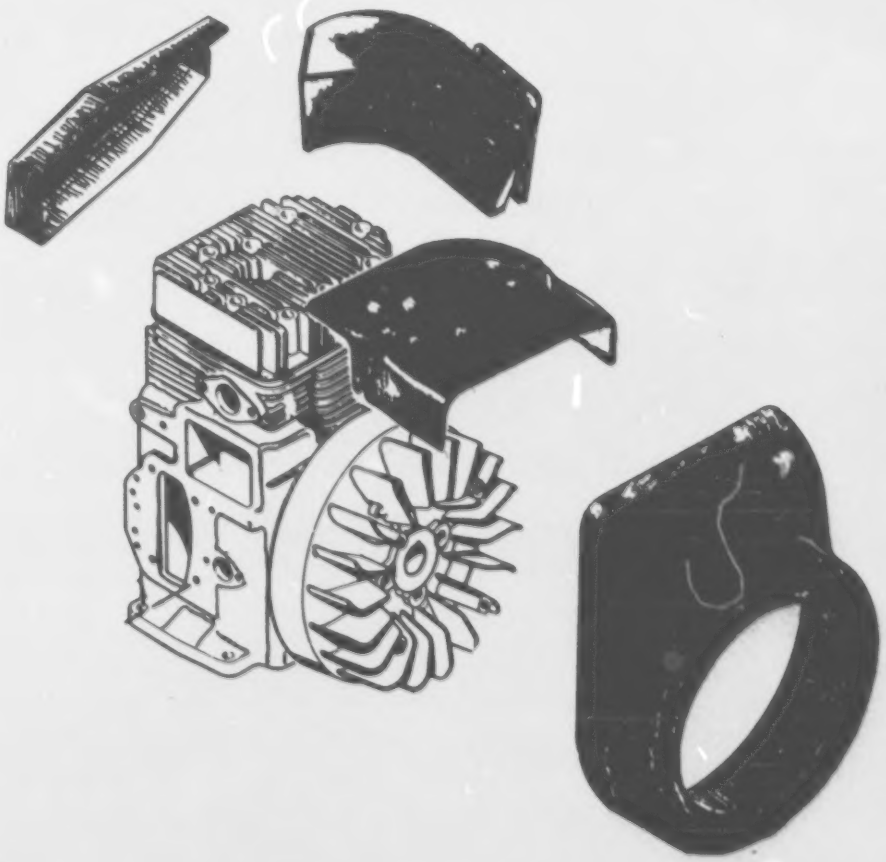
TURN THE PAGE AND BEGIN

Unit 7
Cleaning and Inspecting the Cooling System

Introduction

It is important that you service the small engine regularly if you expect trouble-free operation. Small engines are air cooled and must be kept free of dirt and trash especially around cylinder head and fins.

This unit will show you how to inspect and clean the cooling system on small engines.



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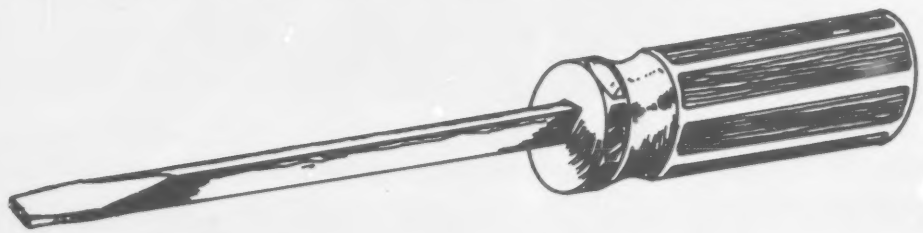
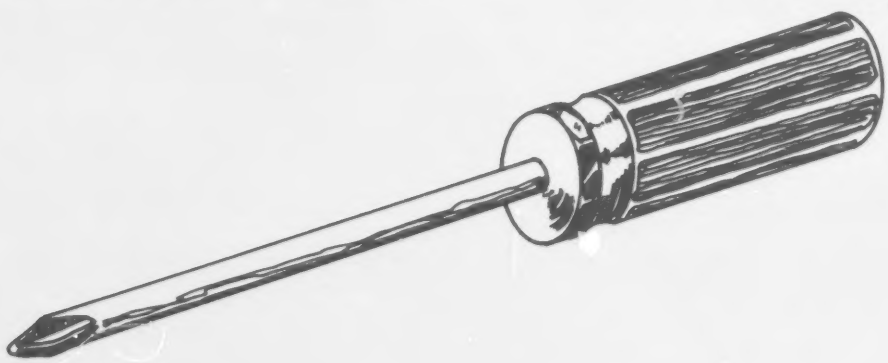
Unit 7
Cleaning and Inspecting the Cooling System

A. Tools, Materials and Equipment for Cleaning and Inspecting the Cooling System.

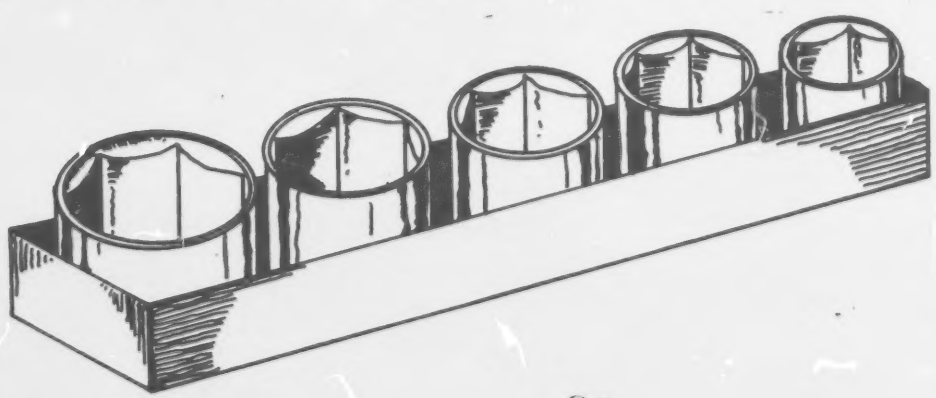
1. **STANDARD SCREWDRIVER:** Used to remove standard screws.



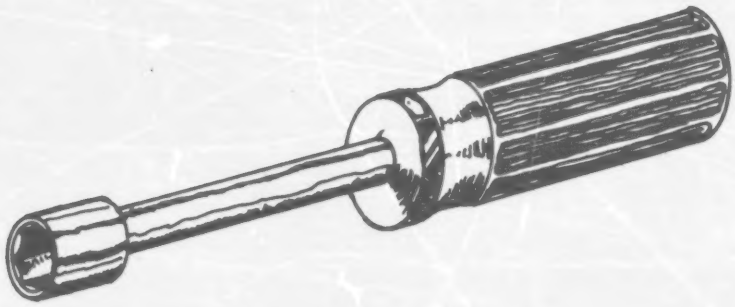
2. **PHILLIPS SCREWDRIVER:** Used to remove phillips screws.



3. **SOCKET SET:** Attached to socket wrench to remove and tighten nuts and bolts in hard to reach places.

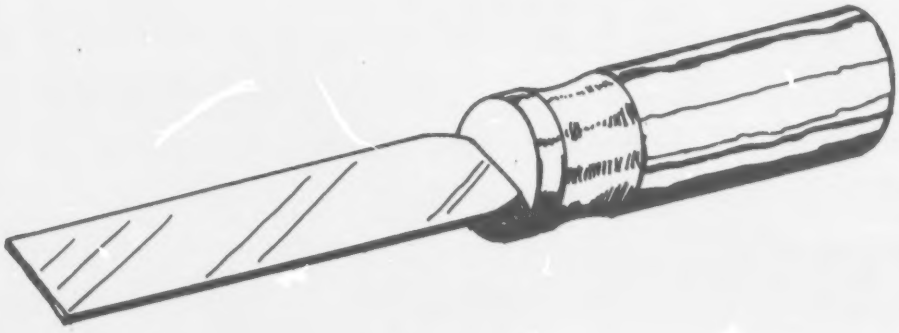


4. **NUT DRIVERS:** Used to remove and tighten nuts and bolts.

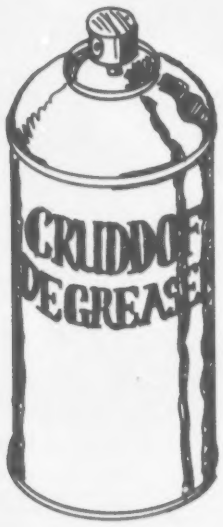


5. **OPEN-END WRENCH SET:** Used to remove and tighten nuts and bolts.

6. **PUTTY KNIFE:** Used to clean dirt and grease from small engine.



7. **DEGREASER:** Used in removing oil and grease from engine.



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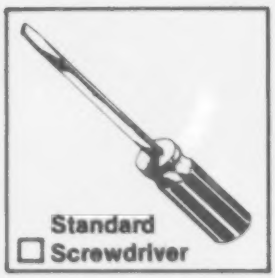
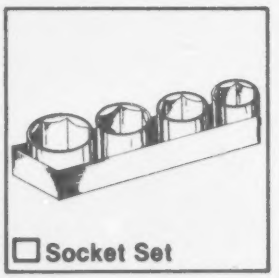
B. Steps for Cleaning and Inspecting the Cooling System.

1. Find and Check Off the following:



☐ Standard Screwdriver

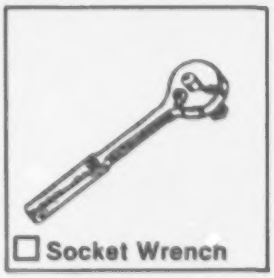
☐ Phillips Screwdriver



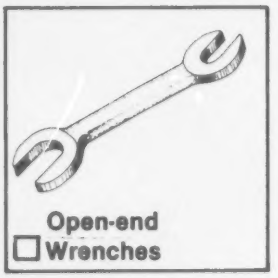
☐ Socket Set

☐ Nut Drivers

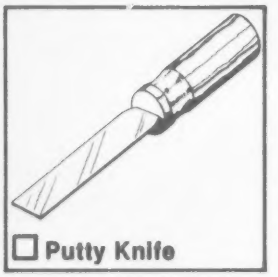
☐ Small Pan and Solvent



☐ Socket Wrench



☐ Open-end Wrenches



☐ Putty Knife

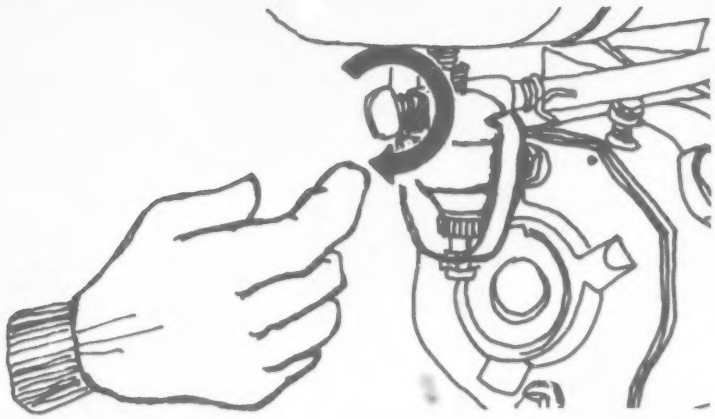
☐ Wire Brush

☐ Degreaser

☐ Safety Equip.

2. Wear proper safety equipment.

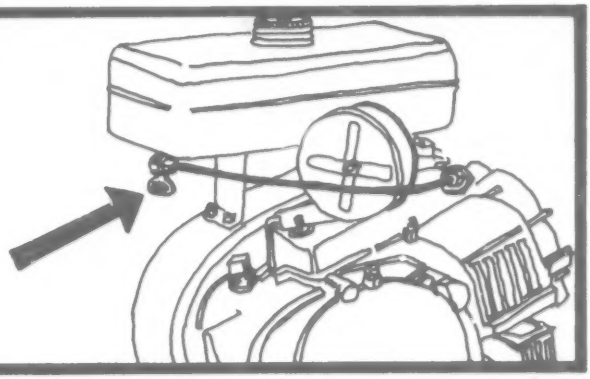
3. Close fuel shut-off valve.



Shut-off valve may be part of sediment bowl.

NOTE!

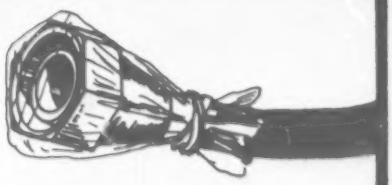
Shut-off valve is sometimes located under gas tank.



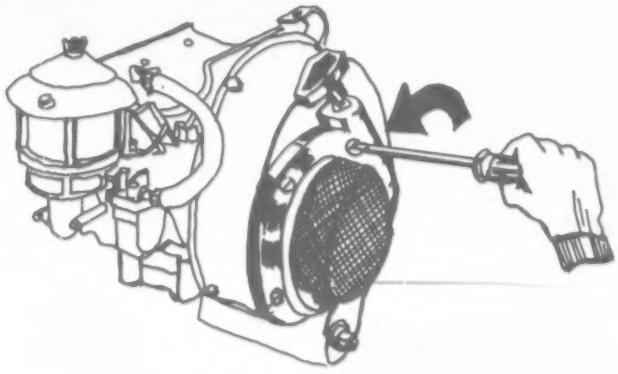
4. Disconnect gas line and remove fuel tank.

NOTE!

Be sure to cover the end of fuel line while you are cleaning engine.



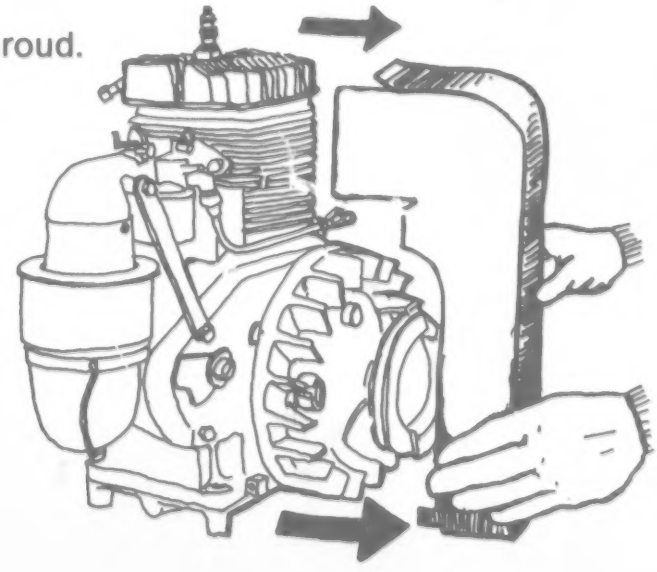
5. Remove recoil starter.



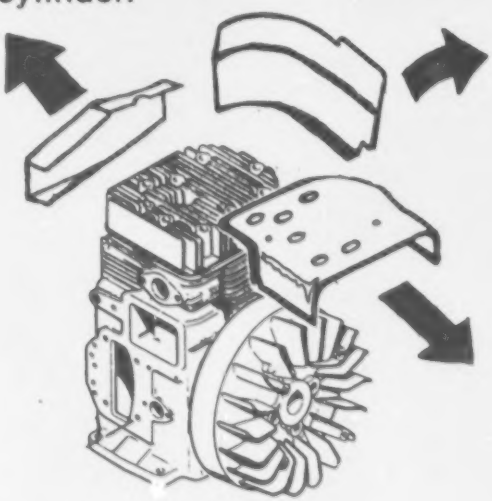
NOTE!

On some small engines, the starter and screen must be removed before the shroud can be removed.

6. Remove blower shroud.



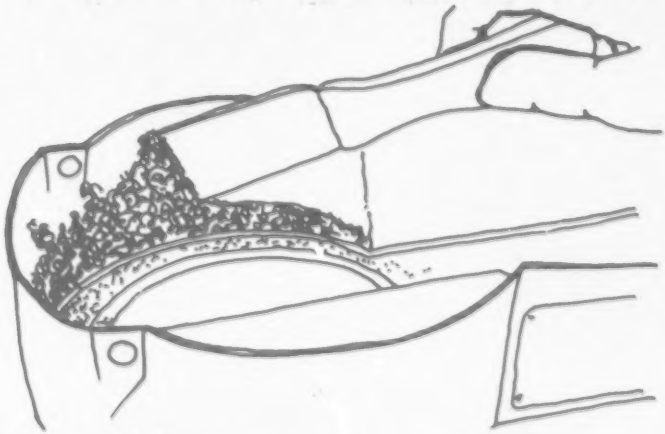
7. Remove remaining shroud covers which cause air to blow around and over cylinder.



8. Use brush to clean deposits from screen.

Wash in solvent and dry.

9. Use putty knife for removing dirt and grease from shroud.

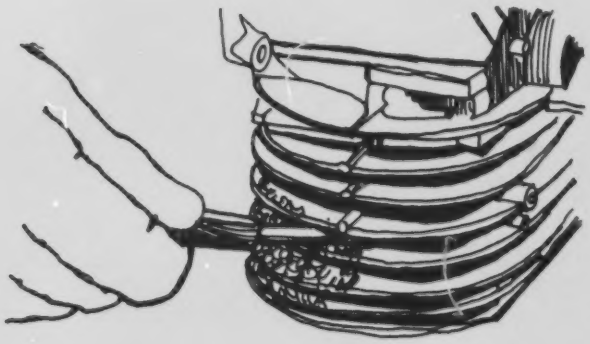


Wash in solvent and dry.

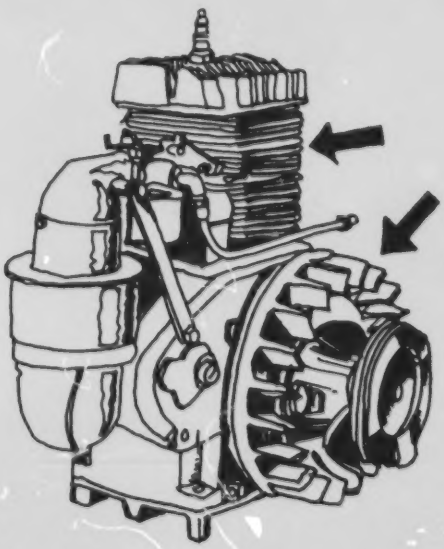
NOTE!

Use care not to damage engine parts with putty knife blade.

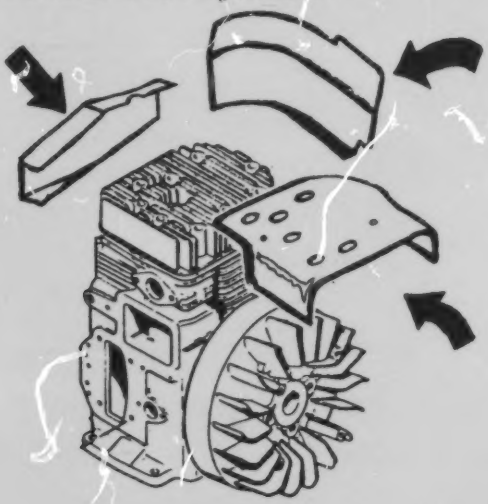
10. Clean dirt from cylinder fins and flywheel.



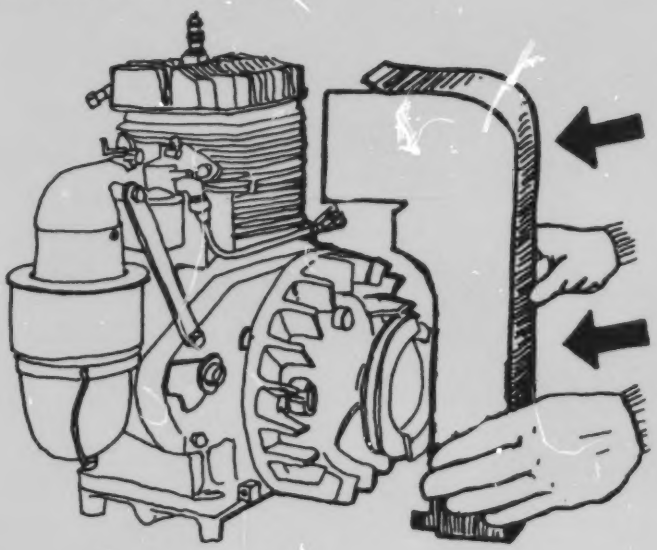
11. Clean and inspect engine for dirt deposits on hidden parts. Inspect cylinder for cracks and broken cooling fins.



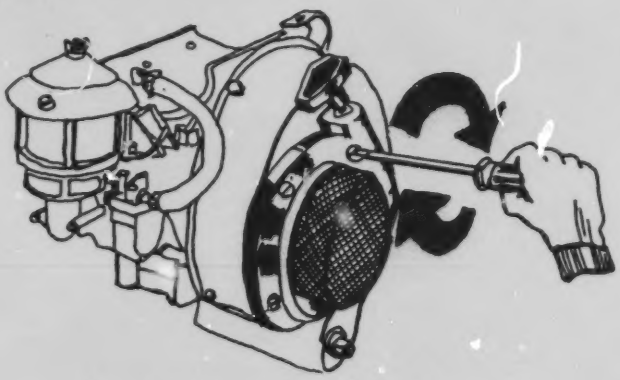
12. Replace shroud covers over cylinder.



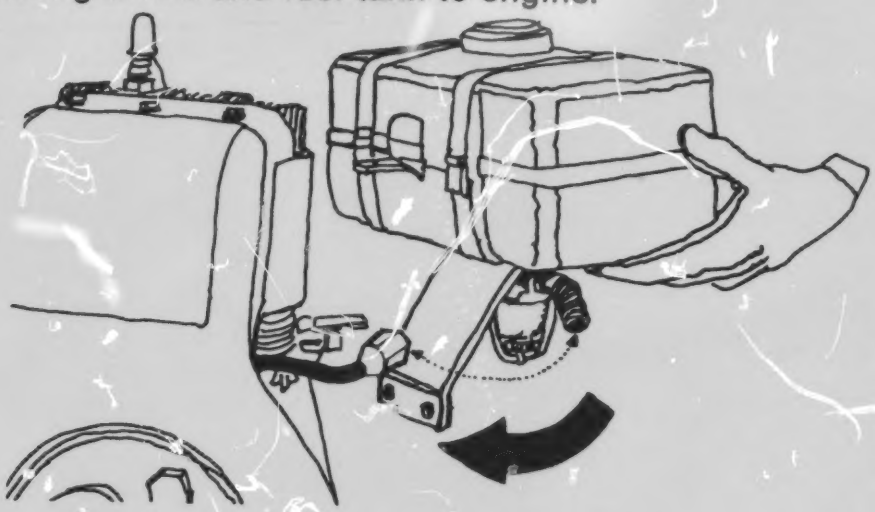
13. Replace blower shroud.



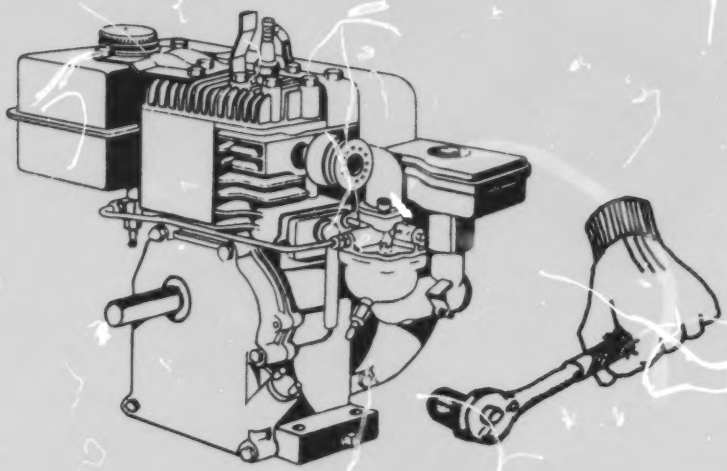
14. Replace recoil starter.



15. Connect gas line and fuel tank to engine.



16. Check other nuts, screws, and bolts to make certain they are tight.



17. Clean your work area and return tools to their proper places.

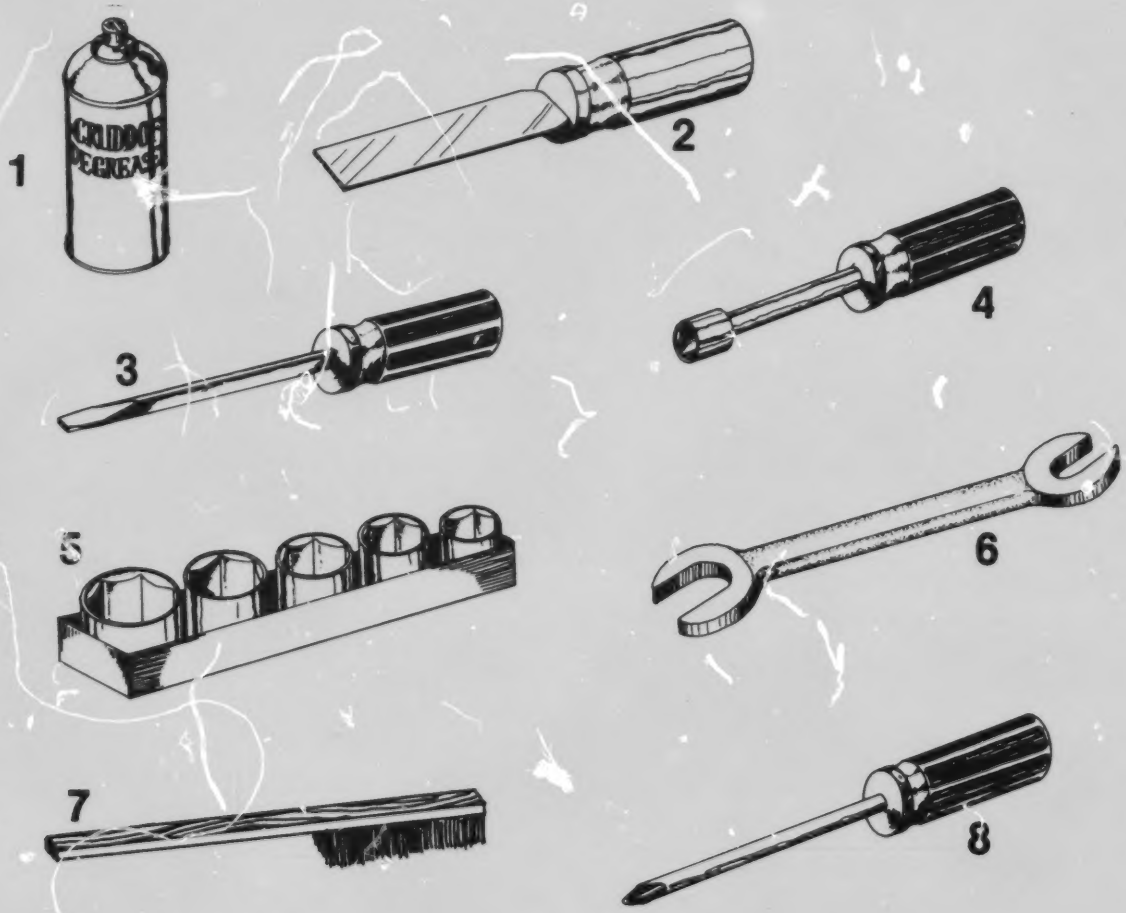
SEE YOUR INSTRUCTOR

Unit 7
Cleaning and Inspecting the Cooling System

Tools and Materials Identification Exercise

Match each object with its correct name.

___A. Standard Screwdriver
___B. Phillips Screwdriver
___C. Socket Set
___D. Open-end Wrench
___E. Putty Knife
___F. Wire Brush
___G. Degreaser
___H. Nut Driver



Unit 7
Cleaning and Inspecting the Cooling System

Practical Exercise Performance Checklist

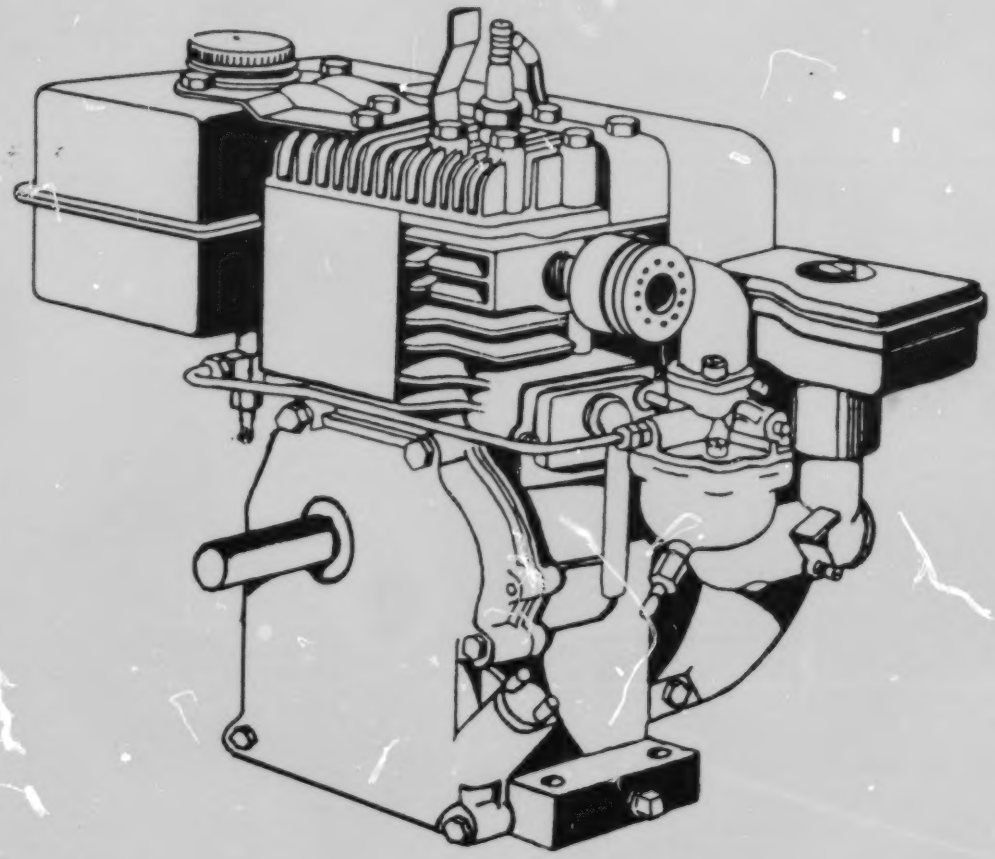
The student_____successfully performed the following tasks:

Tasks	Yes	No	Comments
1. Identified			
a. Standard screwdriver			
b. Phillips screwdriver			
c. Socket set			
d. Open-end wrench set			
e. Putty knife			
f. Wire brush			
g. Degreaser			
h. Nut drivers			
2. Wore proper safety equipment			
3. Closed fuel shut-off valve			
4. Removed fuel tank			
5. Removed recoil starter			
6. Removed blower shroud			
7. Removed shroud covers			
8. Used brush to clean screen			
9. Used putty knife to clean shrouds			
10. Cleaned dirt and grease from cylinder fins and flywheel			
11. Cleaned and inspected engine and cylinder for cracks and broken parts			
12. Replaced shroud covers			
13. Replaced blower shroud			
14. Replaced recoil starter			
15. Reconnected gas line and fuel tank			
16. Checked tightness of other screws, nuts and bolts			
17. Cleaned work area and returned tools to their proper places			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 8

Servicing Small Engine Air Cleaners

PRACTICAL ARTS AND VOCATIONAL TECHNICAL EDUCATION
IMI
INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 8
Servicing Small Engine Air Cleaners

Servicing Small Engine Air Cleaners

After you study this lesson, you should be able to:

1. Identify tools and materials used in servicing small engine air cleaners.
2. Clean and service a small engine air cleaner.

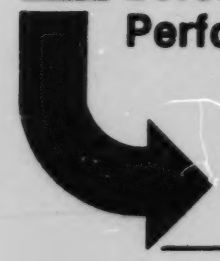
Show What You Can Do

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**



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Unit 8
Servicing Small Engine Air Cleaners

Introduction

Air cleaners are one of the most important parts of a small engine. Purpose of an an air cleaner is to remove dust and dirt from air going into the engine. Life of small engines depends very much on air cleaners.

Three types of air cleaners are used on small gasoline engines: Oil-bath, Dry-filter, and Oiled-filter types. When properly serviced they will do a satisfactory job of removing dirt. This unit will show you how to identify and service each type.

Oil-bath type

Dry-filter type

Oiled-filter type

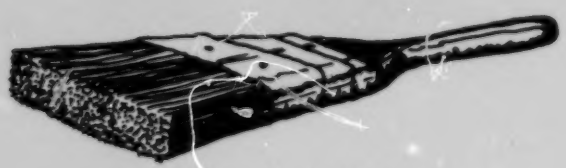
TURN TO NEXT PAGE

Unit 8
Servicing Small Engine Air Cleaners

A. Tools, Materials and Equipment for Servicing Small Engine Air Cleaners

1. **WOODEN SCRAPER:** Used to clean grease and dirt from small engine parts.

2. **PAINT BRUSH:** Used to brush solvent onto parts for removing dust and dirt.



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B. Steps for Servicing Oil-Type Air Cleaner.

1. Find and Check Off the following:

☐ Paint Brush

☐ Wooden Scraper

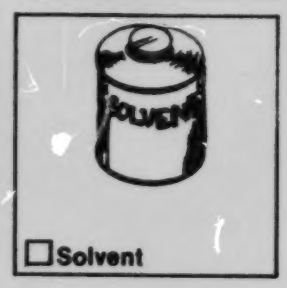
☐ Standard Screwdriver

☐ Phillips Screwdriver

☐ Crankcase Oil

☐ Shop Towels

☐ Pliers



☐ Solvent

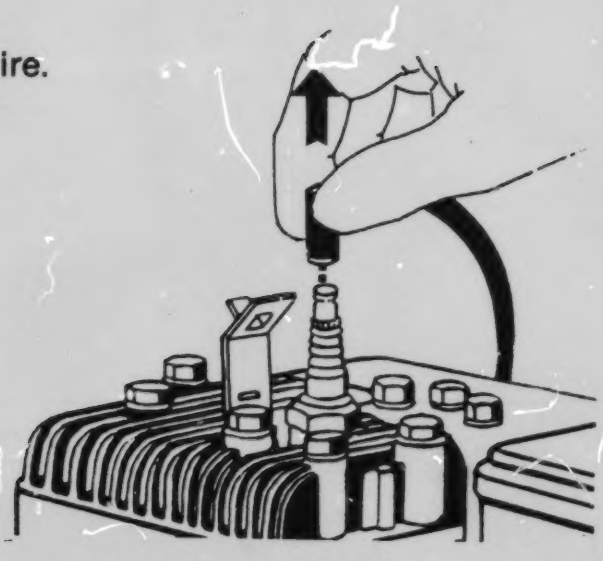
☐ Small Pan

☐ Operator's Manual

☐ Safety Equip.

2. Wear proper safety equipment.

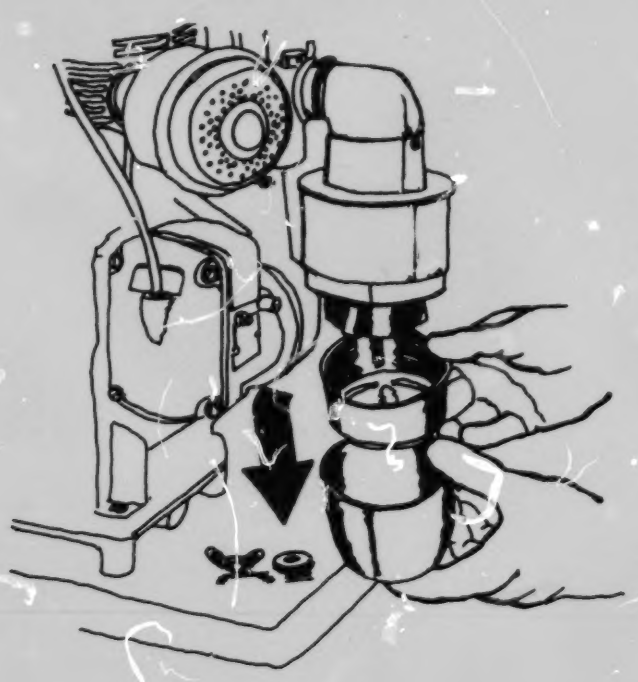
3. Disconnect spark plug wire.



NOTE!

If you are servicing a new engine equipped with an oil-bath type air cleaner, service it before operating engine.

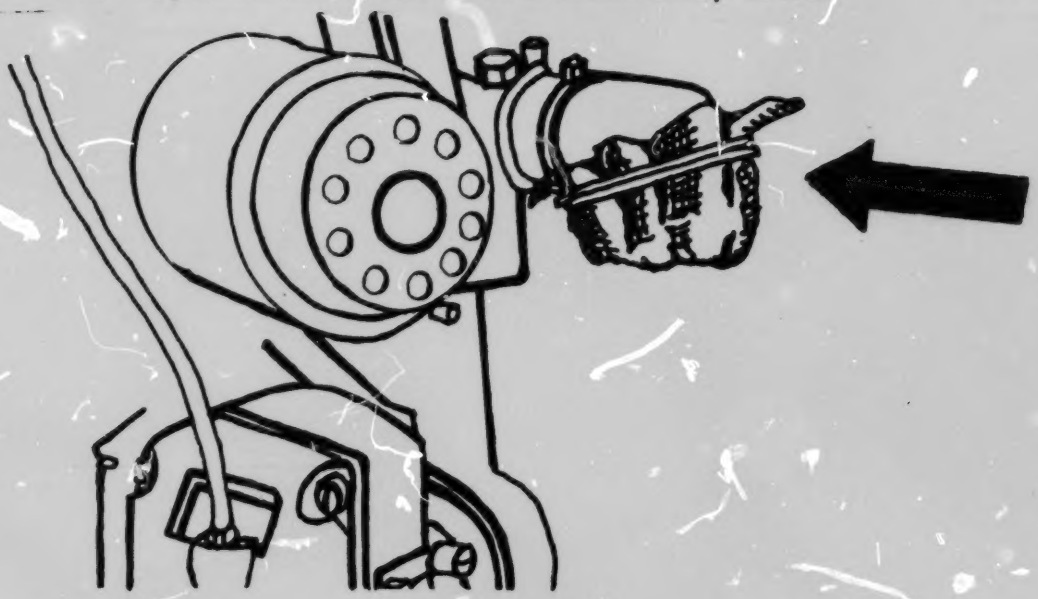
4. Loosen oil cup cover and remove air cleaner.



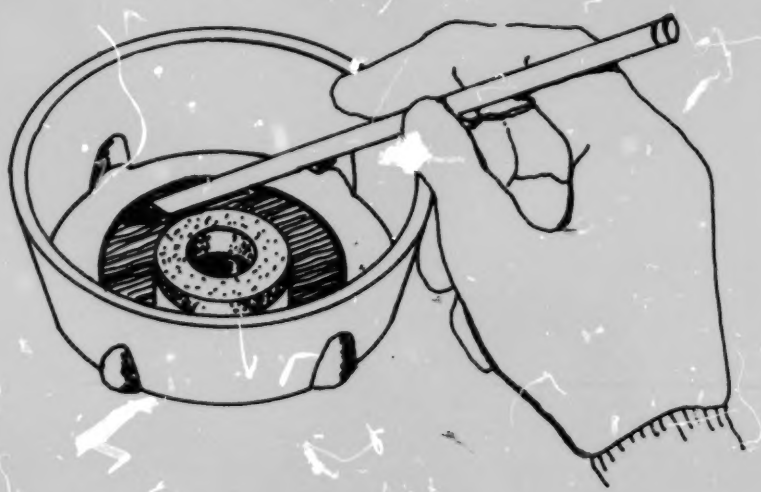
NOTE!

Some engines have a threaded breather body.

5. Cover exposed air intake with a clean shop towel.

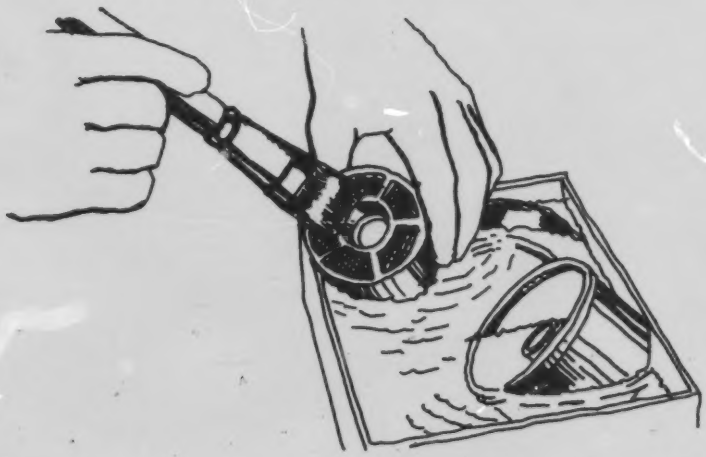


6. Check depth of sediment deposit in bottom of oil cup.



7. If sediment deposit is ¼-inch or more, remove dirty oil from cup.

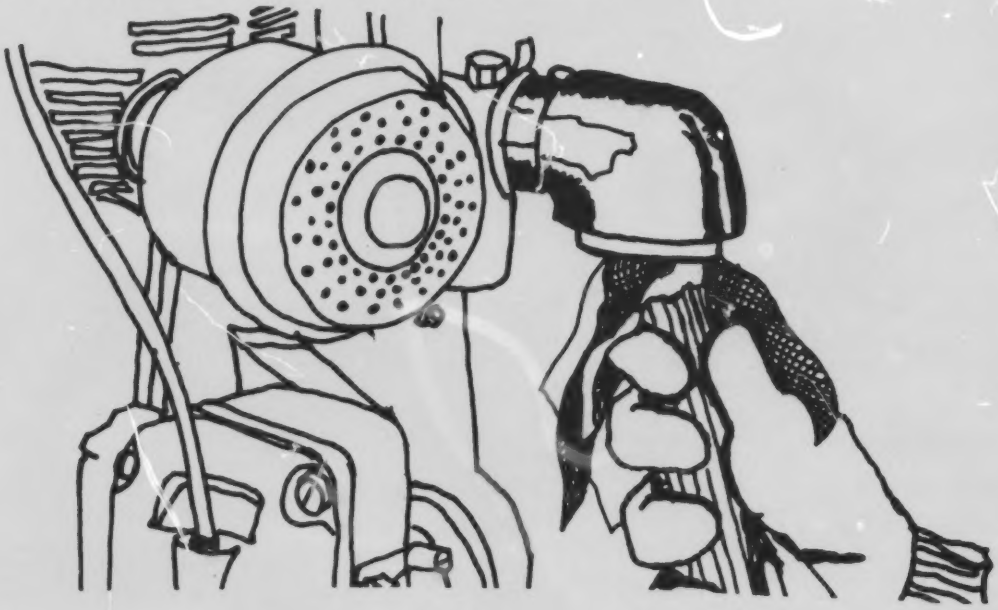
8. Clean cup, filter and other parts with a solvent.



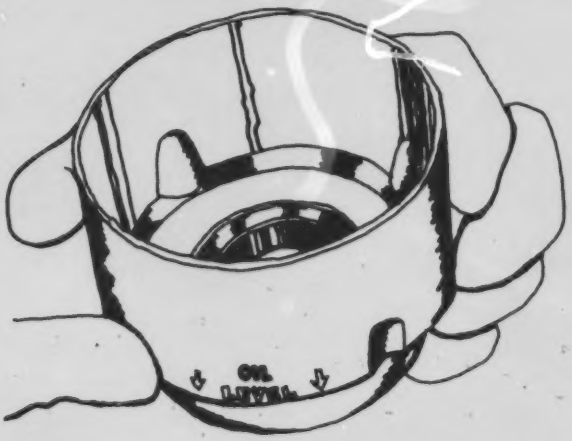
CAUTION!

Do not use gasoline or other highly flammable mixtures to clean parts.

9. Check and clean air intake pipe to carburetor.



10. Refill cup with oil to proper oil level.

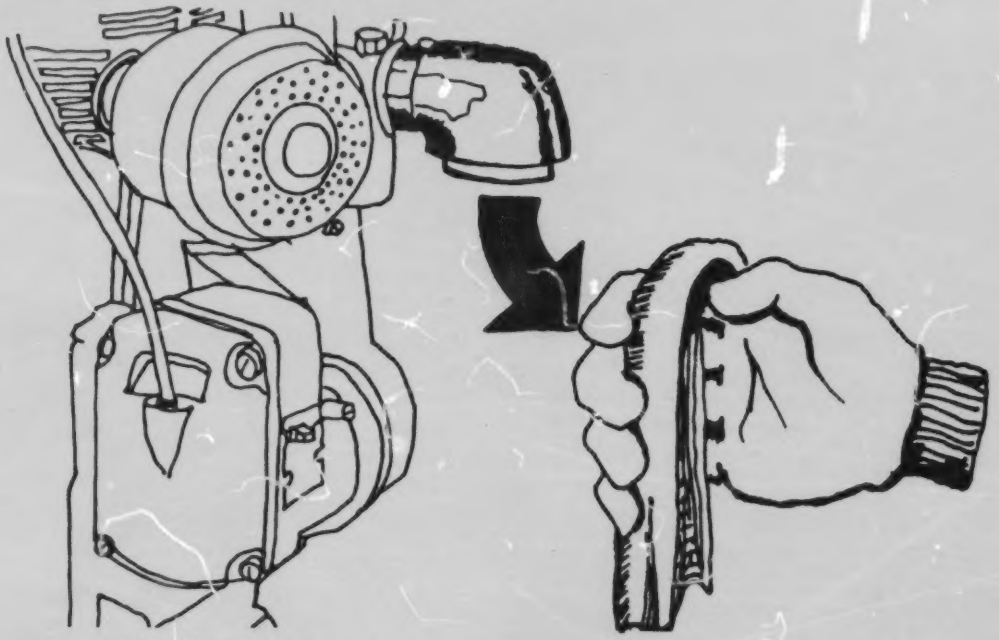


Use same type and grade of oil as used in crankcase.

NOTE!

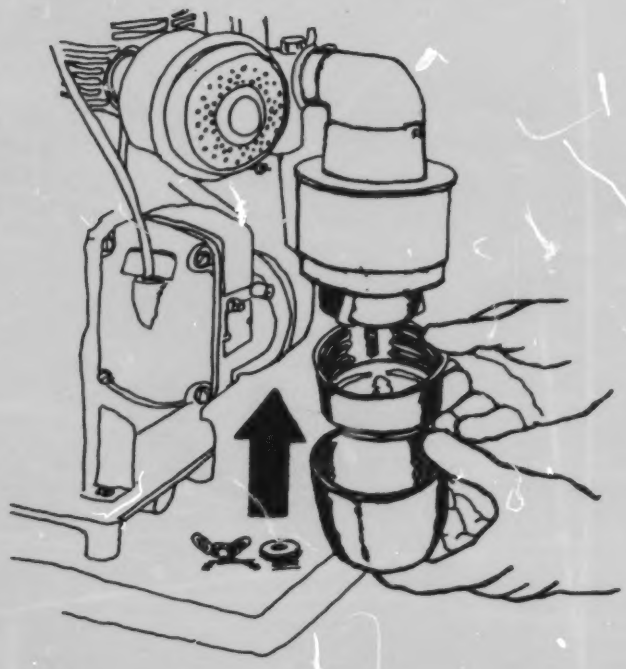
Do not over fill cup.

11. Remove protective cover from intake.



12. Reassemble air cleaner.

13. Attach assembled air cleaner to carburetor.



NOTE!

Replace all gaskets and tighten all clamps.

14. Reconnect spark plug wire.

15. Clean your work area and return tools to their proper places.

C. **Steps for Servicing the Dry-Filter Type Air Cleaner.**

NOTE!
If you are servicing a new engine equipped with a dry-filter type air cleaner, service it before operating engine.

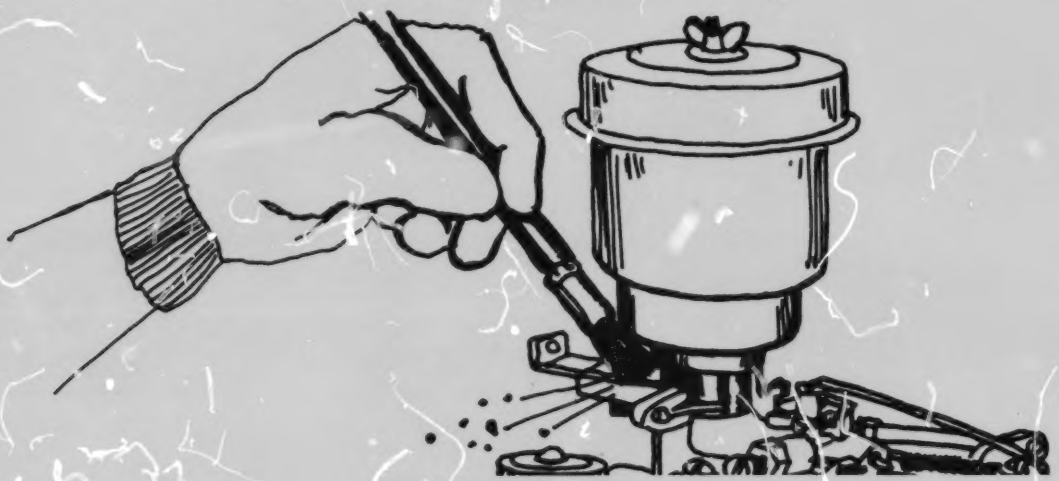
1. Wear proper safety equipment.

2. Disconnect spark plug wire.

CAUTION!

Never work on an engine while it is running.

3. Clean area around air cleaner.

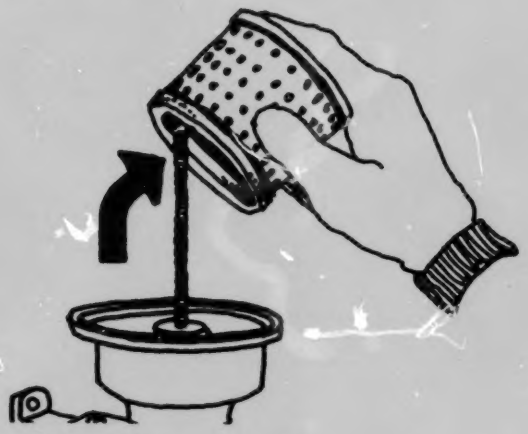


NOTE!

Proper cleaning prevents surface dirt from falling into carburetor intake.

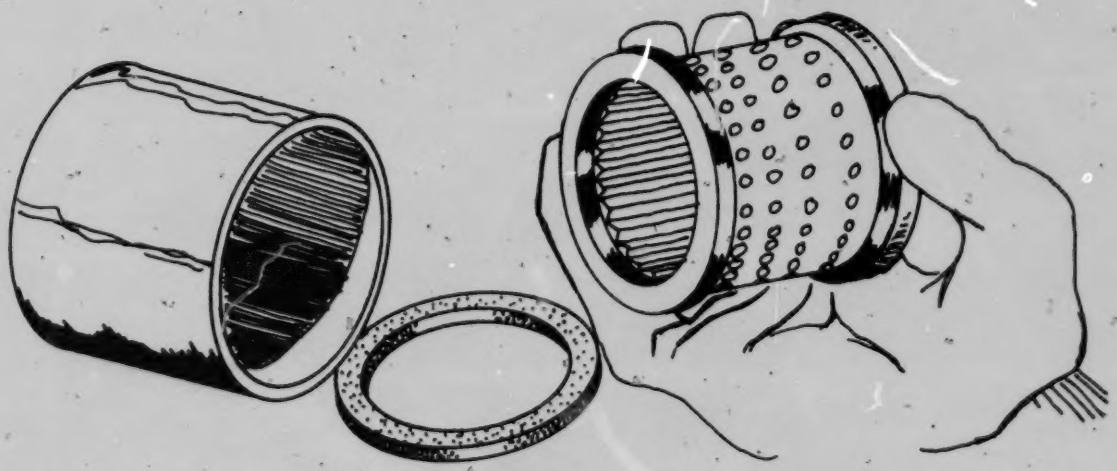
4. Remove air filter cover.

5. Remove air filter element.

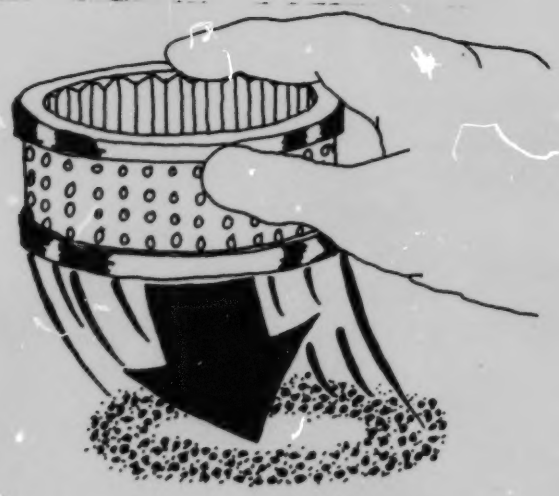


6. Cover carburetor air intake with clean shop towel.

7. Check condition of filter element and other parts.



8. Clean air filter element.



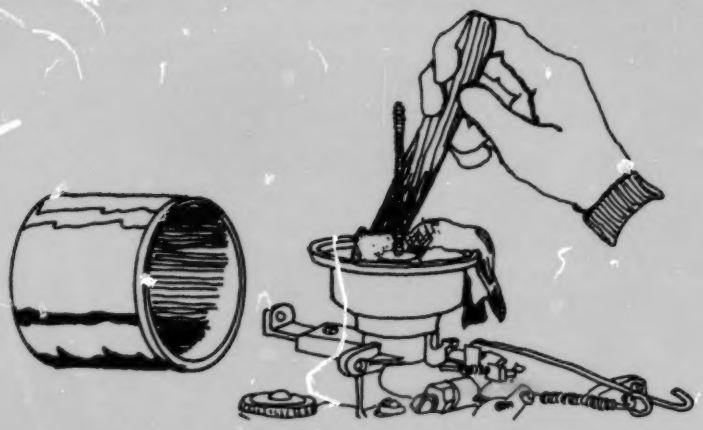
NOTE!

Some dry element filters can be washed, then air dried.

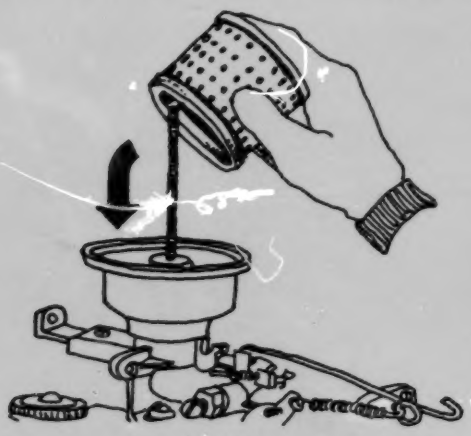
9. Replace air filter if it is damaged or when dirt cannot be removed from it.

10. Remove protective cover from carburetor intake.

11. Carefully clean filter cover and carburetor intake.



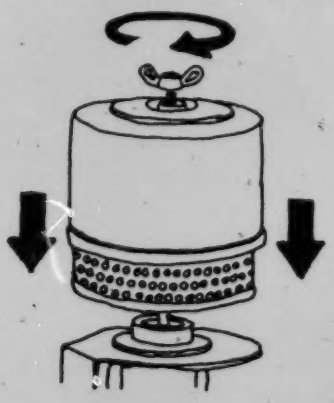
12. Reposition filter element back on carburetor.



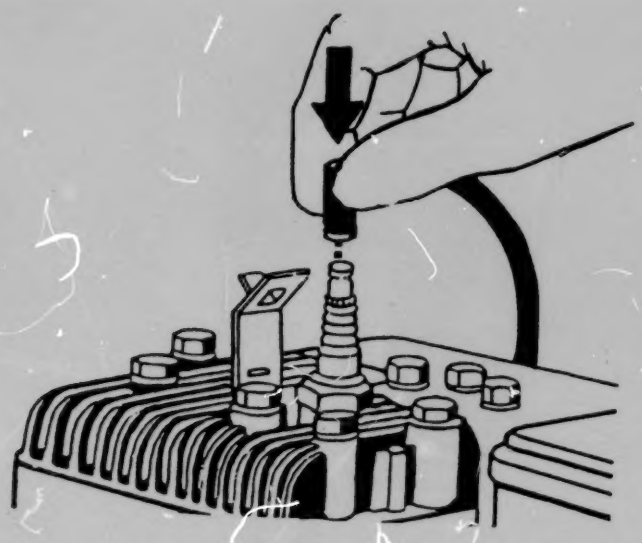
NOTE!

Be sure and install gasket or grommet.

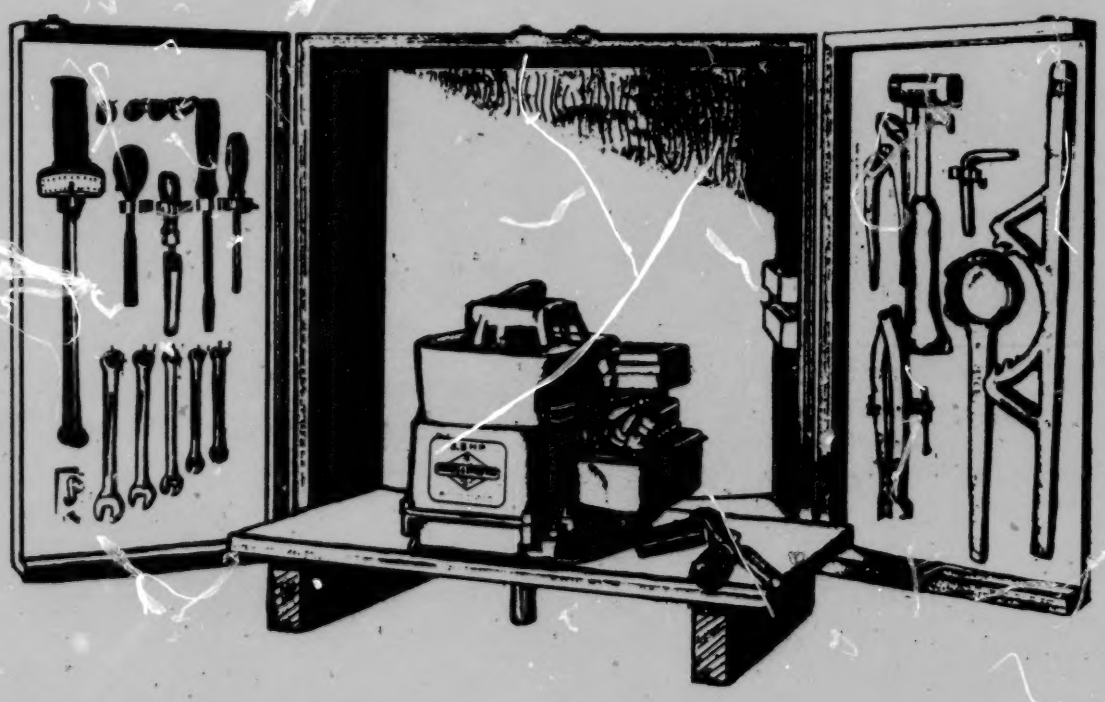
13. Replace cover. Tighten wing nut finger tight.



14. Reconnect spark plug wire.



15. Clean your work area and return tools to their proper places.

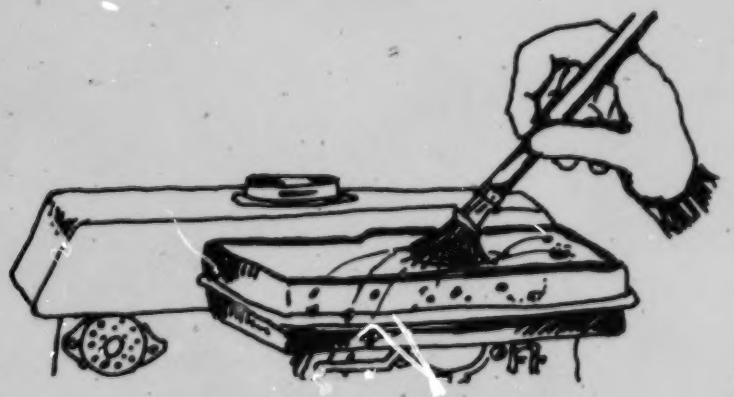


D. Steps in Servicing Oiled-Filter Type Air Cleaner

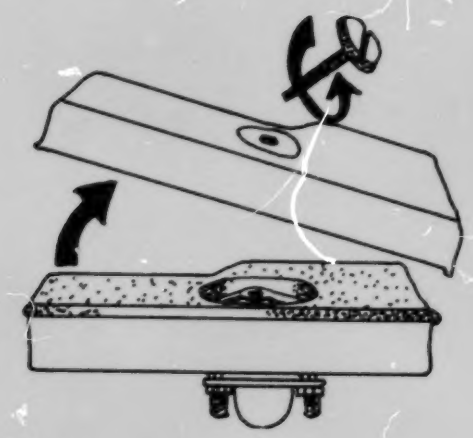
1. Wear proper safety equipment.

2. Disconnect spark plug wire.

3. Clean area around air cleaner.

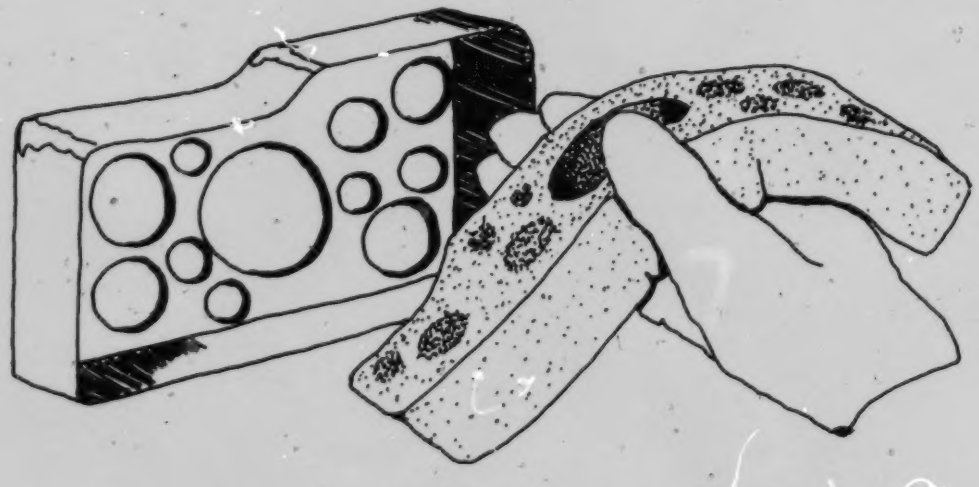


4. Remove filter-element cover.



5. Remove filter element from filter body.

6. Check condition of filter element and other parts of air cleaner.

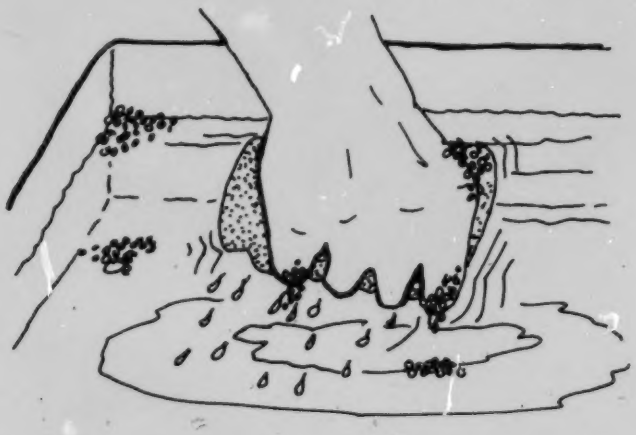


NOTE!

If filter is brittle it should be replaced.

7. Cover carburetor air intake with shop towel.

8. Clean filter by washing in soap and water.



9. Dry filter element by squeezing and air drying.

NOTE!

Dry polyurethane filter by squeezing. Dry metal mesh element by compressed air or by swishing filter through air.

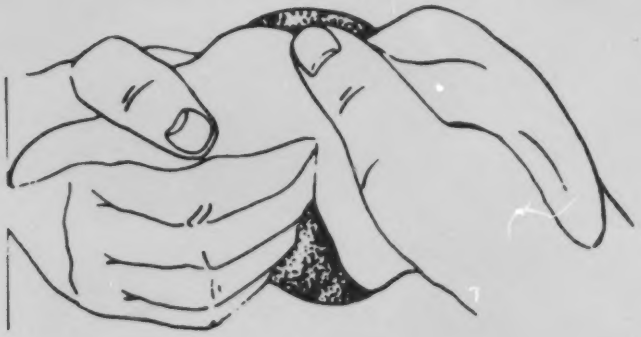
10. Remove protective cover from carburetor intake.

11. Clean carburetor intake.

12. Oil the filter element by saturating filter with oil.

13. Squeeze several times to insure an even distribution of oil in filter.

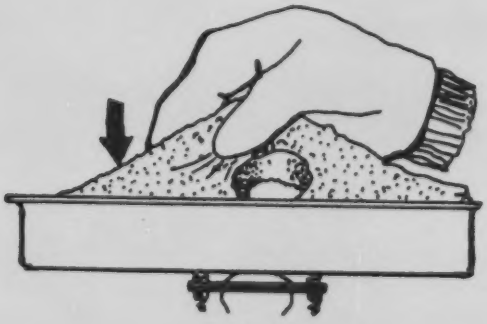
14. Squeeze filter in a cloth to remove excess oil.



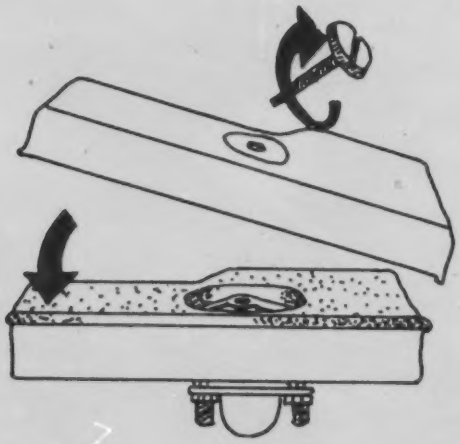
NOTE!

Too much oil will be drawn into engine and foul spark plug.

15. Install filter element back into filter body.



16. Install filter cover.



17. Reconnect spark plug wire.

18. Clean your work area and return tools to their proper places.

SEE YOUR INSTRUCTOR

Unit 8
Servicing Small Engine Air Cleaners

Practical Exercise Performance Checklist

The student_____successfully performed the following tasks:

Tasks	Yes	No	Comments
1. Identified:			
a. Standard screwdriver			
b. Phillips screwdriver			
c. Small pan			
d. Crankcase oil			
e. Shop towels			
f. Wooden scraper			
g. Paint brush			
h. Pliers			
i. Solvent			
j. Operator's manual			
Servicing Oil-Bath Type Air Cleaner			
2. Wore proper safety equipment			
3. Disconnected spark plug wire			
4. Loosened oil cup cover and removed air cleaner			
5. Covered exposed air intake			
6. Checked depth of sediment deposit in bottom of oil cup			
7. Safely disposed of dirty oil			
8. Properly cleaned cup, filter and other parts with a solvent			
9. Checked and cleaned air intake pipe to carburetor			
10. Refilled cup with oil to proper oil level			
11. Removed protective cover from intake			
12. Reassembled air cleaner in the proper order and tightened			
13. Attached assembled air cleaner on carburetor			
14. Reconnected spark plug wire			
15. Cleaned work area and returned tools to their proper places			

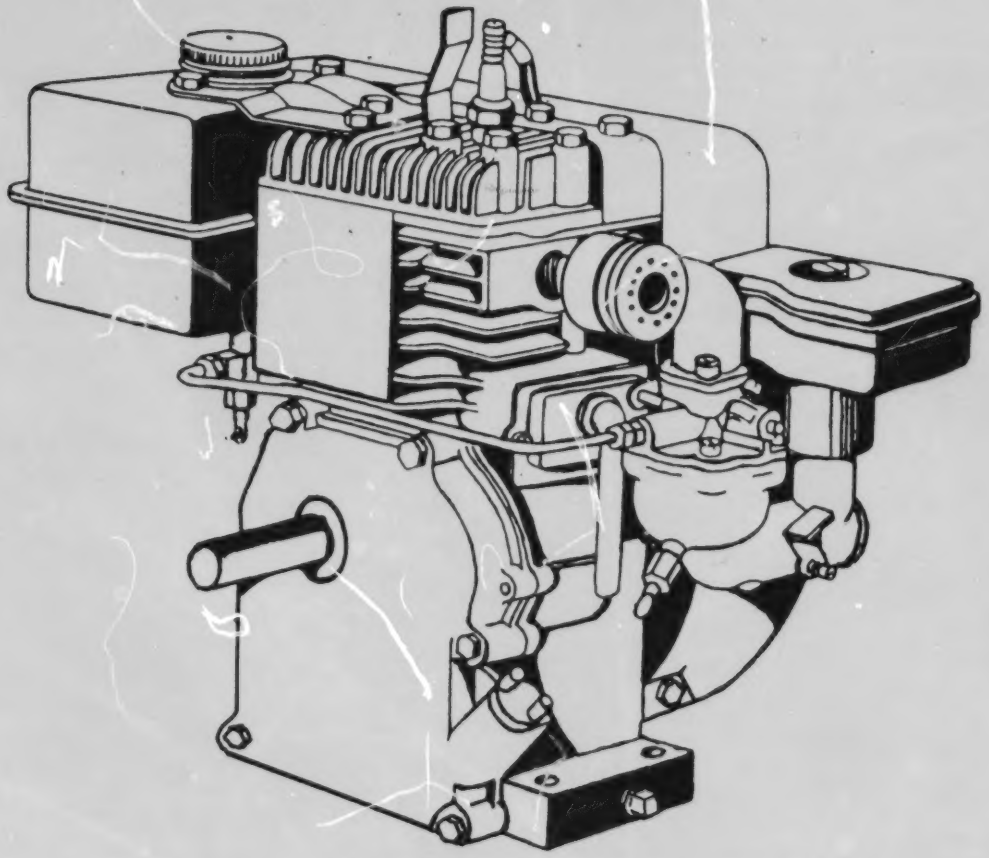
Tasks	Yes	No	Comments
Servicing Dry-Filter Type Air Cleaner			
1. Wore proper safety equipment			
2. Disconnected spark plug wire			
3. Cleaned area around air cleaner			
4. Removed air filter cover			
5. Removed air filter element			
6. Covered carburetor air intake			
7. Checked condition of filter element and other parts			
8. Properly cleaned air filter element or replaced if necessary			
9. Removed protective cover from carburetor intake			
10. Cleaned filter cover and carburetor intake			
11. Repositioned filter element back on carburetor			
12. Replaced cover and tightened			
13. Reconnected spark plug			
14. Cleaned work area and returned tools to their proper places			

Tasks	Yes	No	Comments
Servicing Oiled-Filter Type Air Cleaner			
1. Wore proper safety equipment			
2. Disconnected spark plug wire			
3. Cleaned area around air cleaner			
4. Removed filter-element cover			
5. Removed filter element from filter body			
6. Checked filter element and other parts for damage			
7. Covered carburetor air intake			
8. Properly cleaned air filter element or replaced			
9. Dried filter element			
10. Removed protective cover from carburetor intake			
11. Cleaned filter cover and carburetor intake			
12. Oiled filter element			
13. Squeezed several times for even distribution of oil			
14. Squeezed filter in a cloth to remove excess oil			
15. Installed filter element			
16. Installed filter cover			
17. Reconnected spark plug wire			
18. Cleaned work area and returned tools to proper places			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 9

Cleaning and Inspecting the Crankcase and Exhaust

PRACTICAL ARTS AND VOCATIONAL TECHNICAL EDUCATION
INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 9
Cleaning and Inspecting the Crankcase and Exhaust

Cleaning and Inspecting the Crankcase and Exhaust

After you study this lesson, you should be able to:

1. Identify tools and materials used in cleaning and inspecting the small engine crankcase and exhaust.
2. Clean and inspect small engine crankcase and exhaust.

Show What You Can Do

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

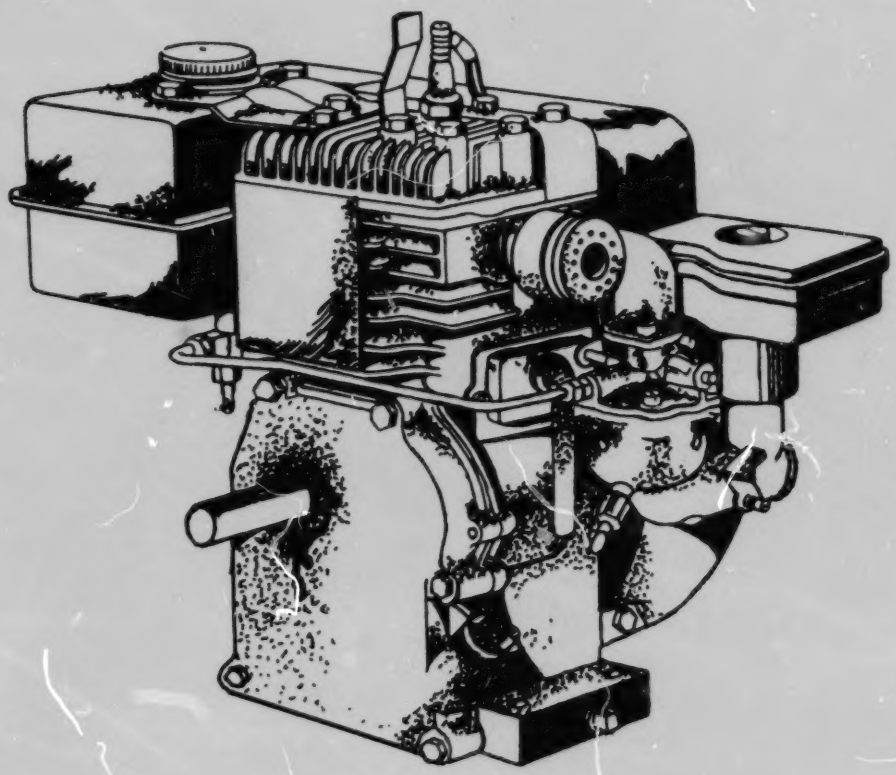
☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

TURN THE PAGE AND BEGIN

Unit 9
Cleaning and Inspecting the Crankcase and Exhaust

Introduction

Failure to clean an engine regularly reduces efficiency and shortens the life of small engines. When you are cleaning an engine, look for loose, broken or worn parts. With the experience of this unit, you will be able to properly inspect and clean crankcase and exhaust systems of small engines.

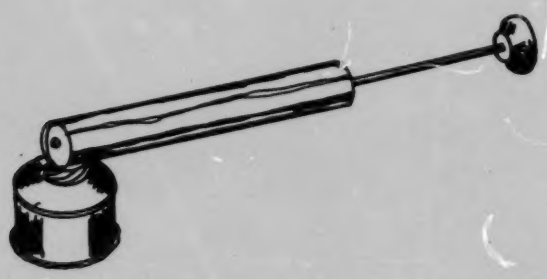


TURN TO NEXT PAGE

Unit 9
Cleaning and Inspecting the Crankcase and Exhaust

A. Tools, Materials and Equipment for Cleaning and Inspecting the Crankcase and Exhaust.

1. **HAND SPRAYER:** Used to apply degreaser to parts of engine .



2. **WATER HOSE:** Used to clean engine and remove solvent.

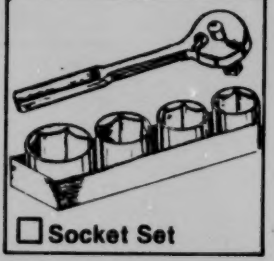
TURN TO NEXT PAGE

B. Steps for Cleaning and Inspecting the Crankcase and Exhaust.

1. Find and Check Off the following:

☐ Standard Screwdrivers

☐ Phillips Screwdrivers


☐ Socket Set

☐ Open-end Wrenches

☐ Nut Drivers

☐ Wire Brush

☐ Small Pan

☐ Paint Brush

☐ Putty Knife

☐ Degreaser

☐ Hand Sprayer

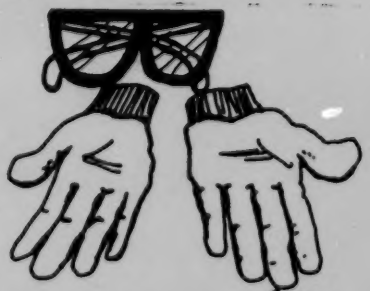
☐ Wooden Scraper

☐ Fire Extinguisher

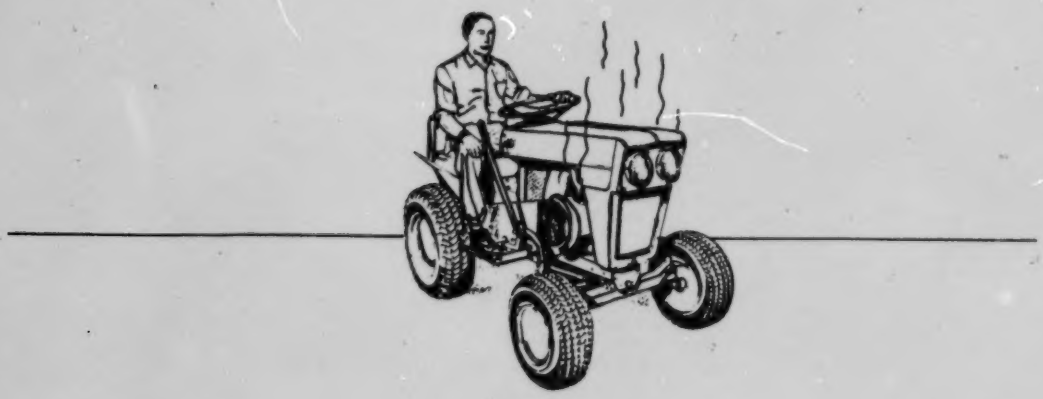
☐ Water Hose

☐ Safety Equip.

2. Wear proper safety equipment.

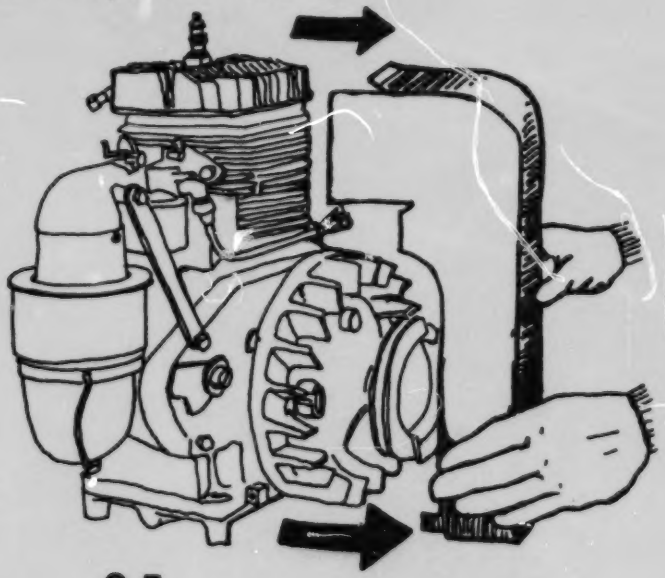


3. Stop engine and allow it to cool if it has been running.

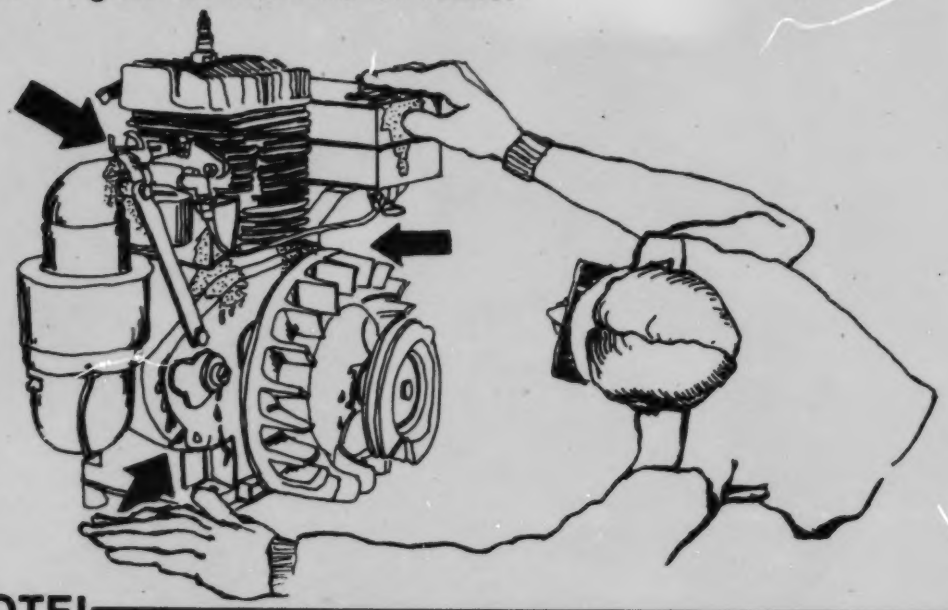


4. Disconnect spark plug wire.

5. Remove blower shroud and cylinder baffles.



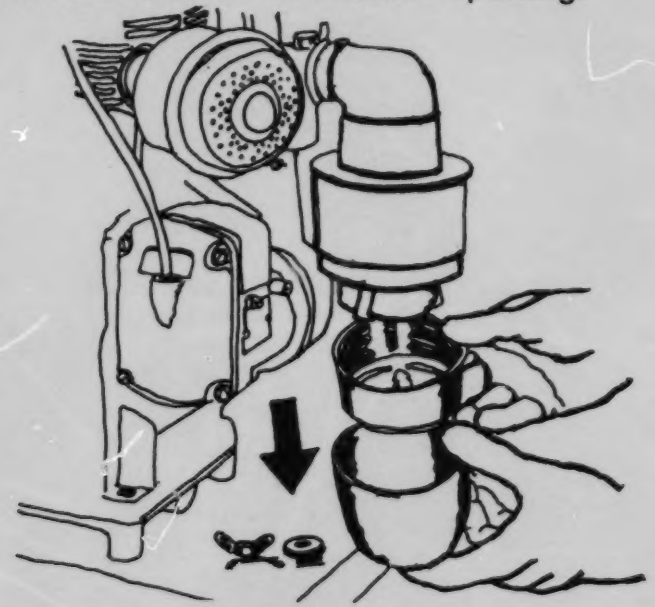
6. Inspect engine for fuel and oil leaks.



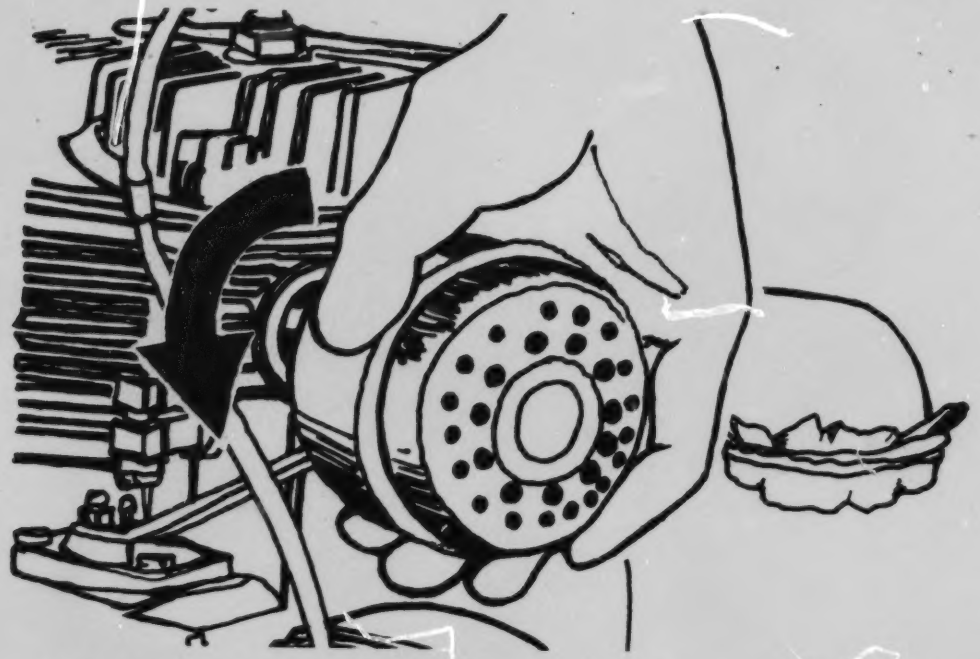
NOTE!

If there is an oil leak, you will see a deposit of dirt around the leak.
If there is a fuel leak, the area will have a reddish deposit left from the gasoline.

7. Remove air cleaner and cover air cleaner opening.



8. Clean and check the exhaust system on a 4-cycle engine by removing the muffler.

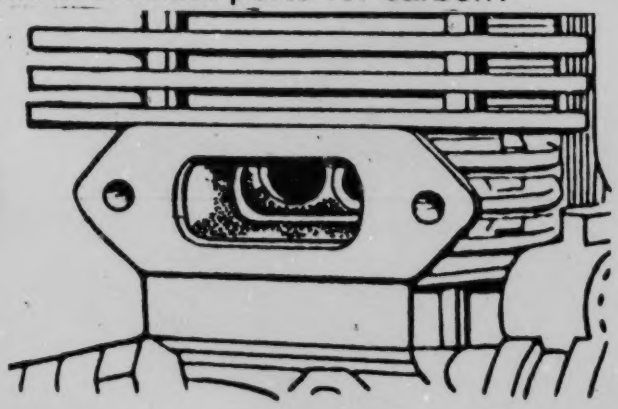


NOTE!

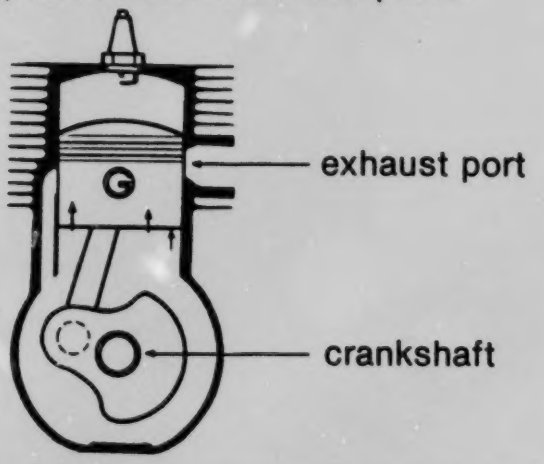
Four-cycle engine exhausts are replaced when the baffles inside the muffler rust out and it becomes noisy.

9. Remove the muffler to clean the exhaust system on a 2-cycle engine.

10. Check cylinder exhaust ports for carbon.



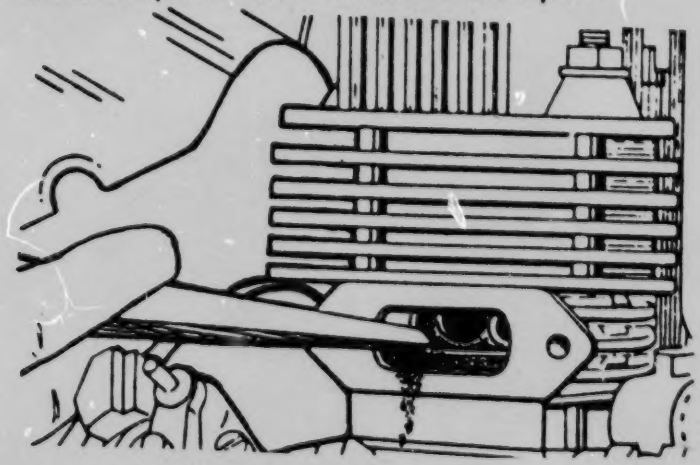
11. Rotate crankshaft until piston covers exhaust ports.



NOTE!

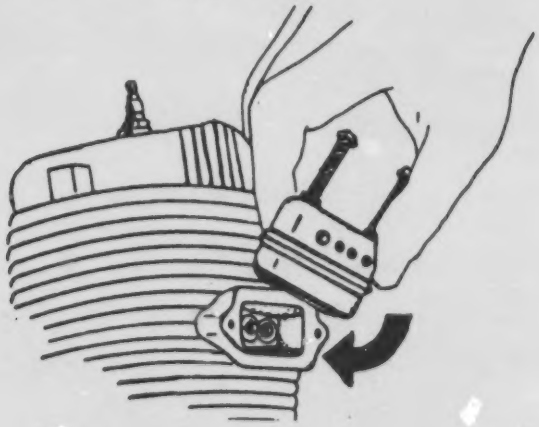
This prevents carbon and dirt from entering cylinder.

12. Clean exhaust ports with wooden scraper.



13. Clean muffler in solvent.

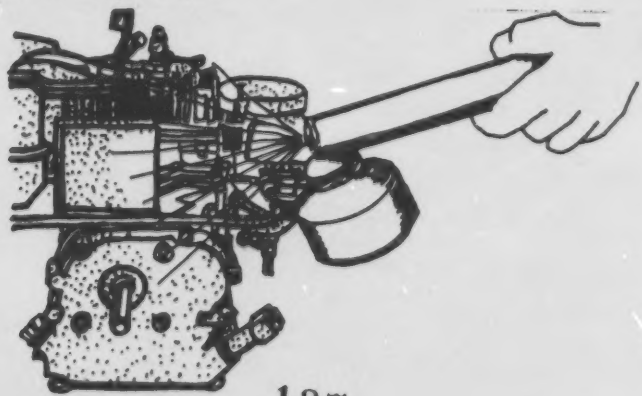
14. Install muffler before cleaning engine.



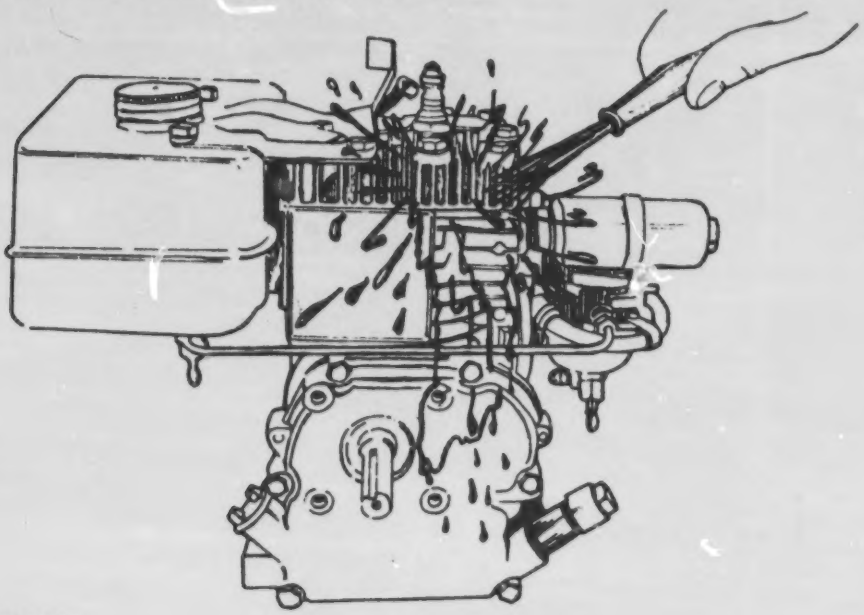
NOTE!

Install a new gasket when installing muffler.
Mufflers vary in shape and design - check your manual for proper replacement.

15. Apply solvent to engine and wait five minutes while solvent loosens grease and oil deposits.



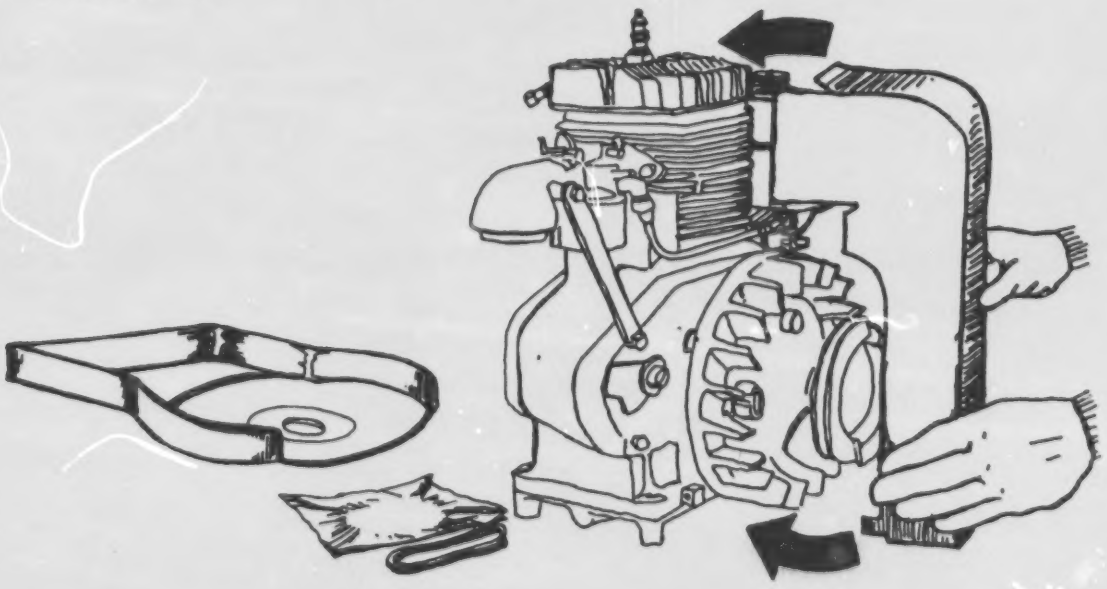
16. Remove solvent from engine surface by using a strong soap solution and flushing with water.



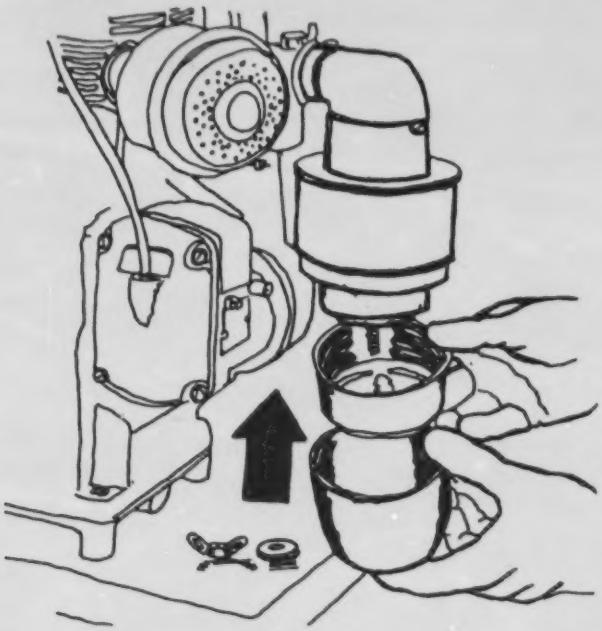
NOTE!

Apply water sparingly around ignition system to avoid shorting the ignition system.

17. Remove protective cover over carburetor and replace shroud and baffles.



18. Replace carburetor air cleaner.

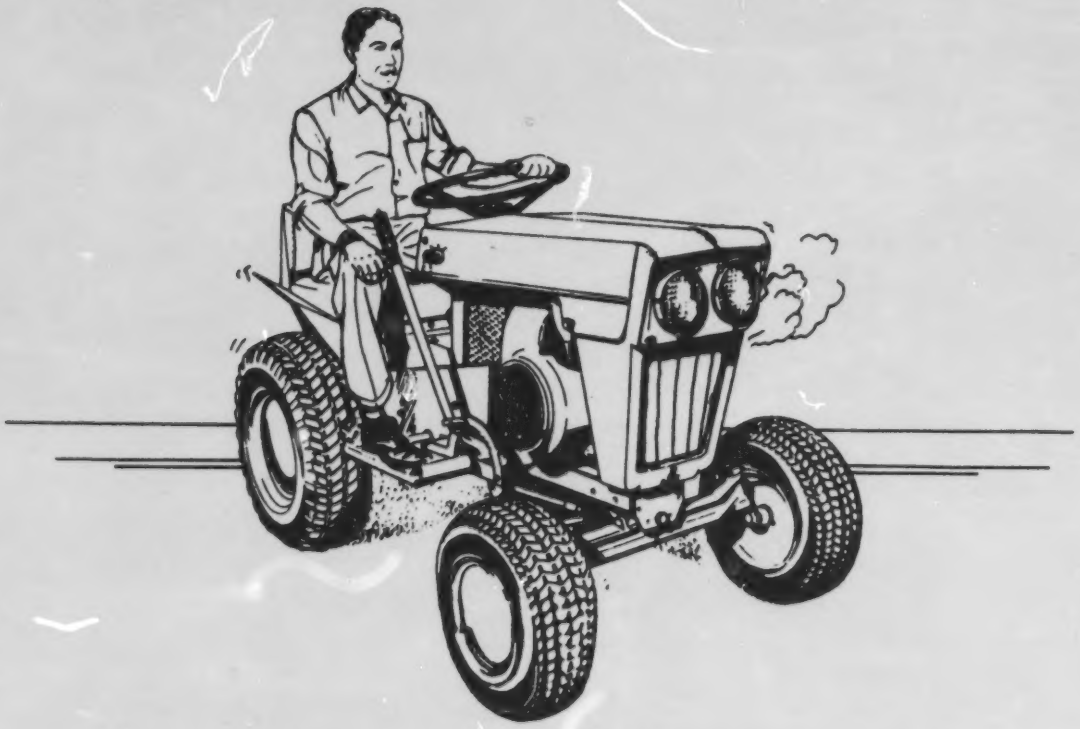


NOTE!

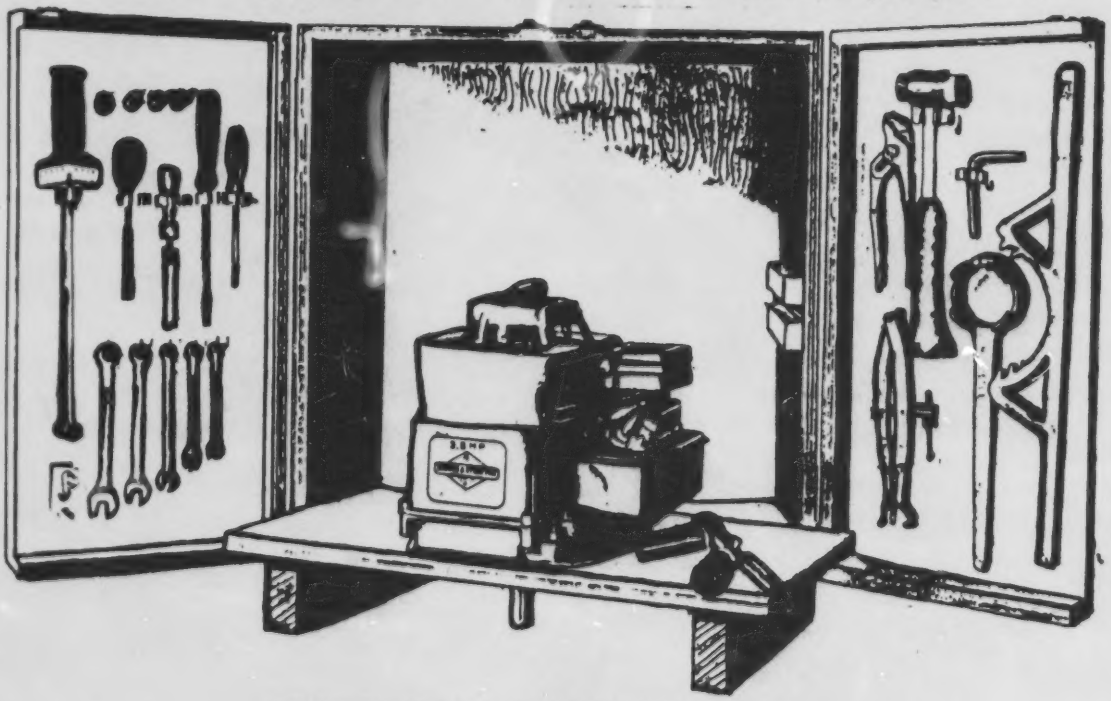
Check with your instructor before starting engine.

19. Reconnect spark plug wire.

20. Operate engine for five minutes to dry engine.



21. Clean your work area and return tools to their proper places.



SEE YOUR INSTRUCTOR

Unit 9
Cleaning and Inspecting the Crankcase and Exhaust

Practical Exercise Performance Checklist

The student_____successfully performed the following tasks:

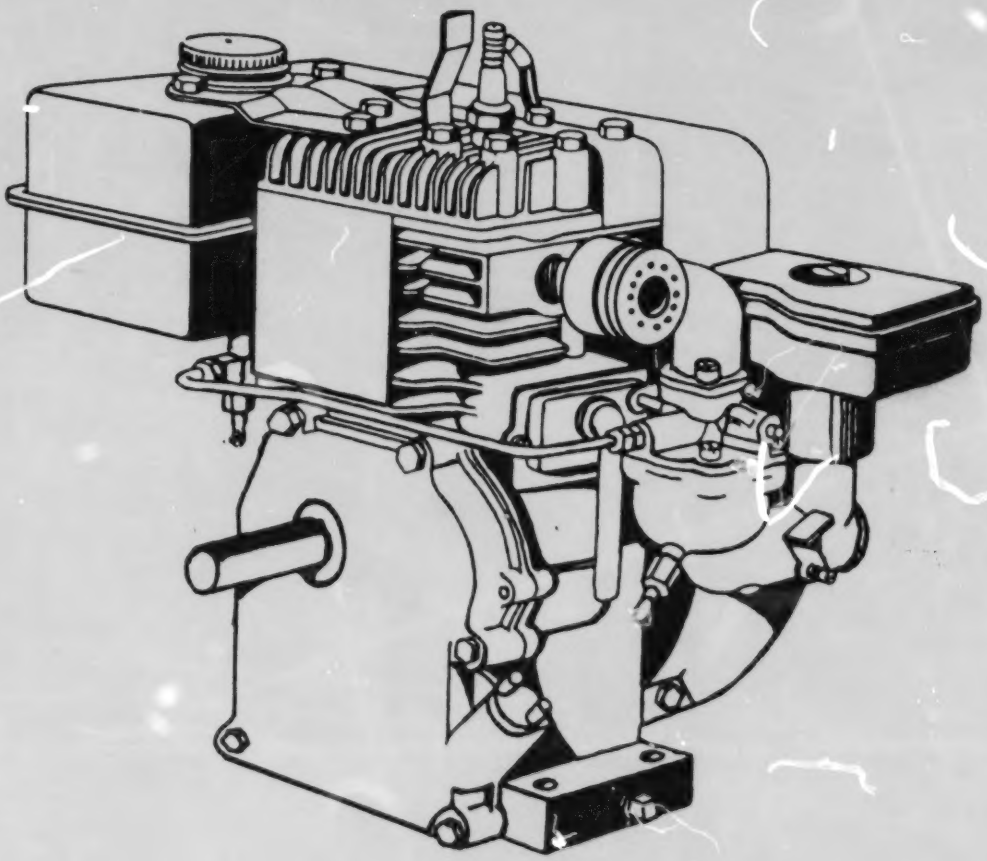
Tasks	Yes	No	Comments
1. Identified:			
a. Standard screwdriver			
b. Phillips screwdriver			
c. Socket set			
d. Open-end wrench			
e. Nut drivers			
f. Wire brush			
g. Small pan			
h. Paint brush			
i. Degreaser			
j. Hand sprayer			
k. Wooden scraper			
l. Water hose			
2. Wore proper safety equipment			
3. Stopped engine and allowed it to cool			
4. Disconnected spark plug wire			
5. Removed blower shroud and cylinder baffles			
6. Inspected engine for fuel and oil leaks			
7. Removed air cleaner and covered carburetor opening			
8. Cleaned and checked exhaust system on a 4-cycle engine			
9. Removed muffler on a 2-cycle engine to clean exhaust system			
10. Checked cylinder exhaust ports for carbon on a 2-cycle engine			
11. Rotated crankshaft until piston covered exhaust ports			

Tasks	Yes	No	Comments
12. Cleaned exhaust ports with wooden scraper			
13. Cleaned muffler in solvent			
14. Installed muffler before cleaning engine			
15. Cleaned engine using solvent			
16. Used water to remove solvent from engine			
17. Removed covering from carburetor and replaced shroud and baffles			
18. Replaced carburetor air cleaner			
19. Reconnected spark plug wire			
20. Ran engine for five minutes to dry			
21. Cleaned work area and returned tools to their proper places			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 10

Changing the Oil in a 4-Cycle Engine

PRACTICAL ARTS AND VOCATIONAL-TECHNICAL EDUCATION
IML
INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 10
Changing the Oil in a 4-Cycle Engine

Changing the Oil in a 4-Cycle Engine

After you study this lesson, you should be able to:

1. Identify tools and materials used in changing the oil in a 4-cycle engine.
2. Change crankcase oil in a 4-cycle engine.

Show What You Can Do

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

TURN THE PAGE AND BEGIN

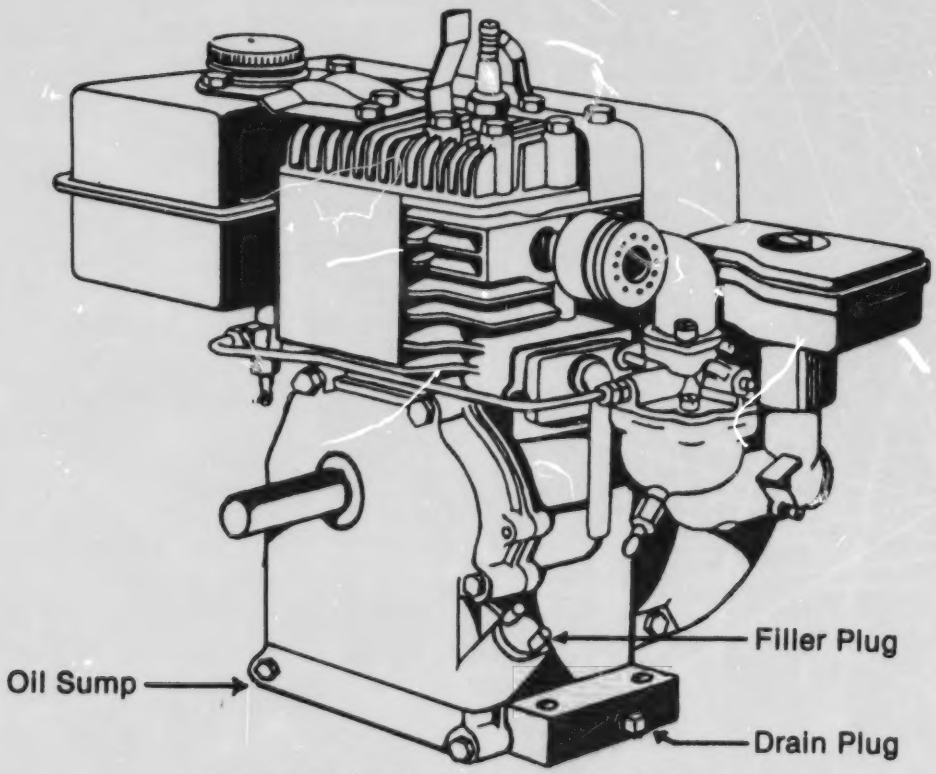
Unit 10

Changing the Oil in a 4-Cycle Engine

Introduction

Proper lubrication of small engines is very important. Oil has two prime functions in the engine, to lubricate working parts of a small engine, and to collect dirt particles, sludge, varnish-forming materials and metal particles.

Oil reaches a point when it can no longer absorb dirt and must be changed. New engine's oil should be changed after two to five hours of operation.
In this unit you will learn how to properly change the oil in a 4-cycle engine.



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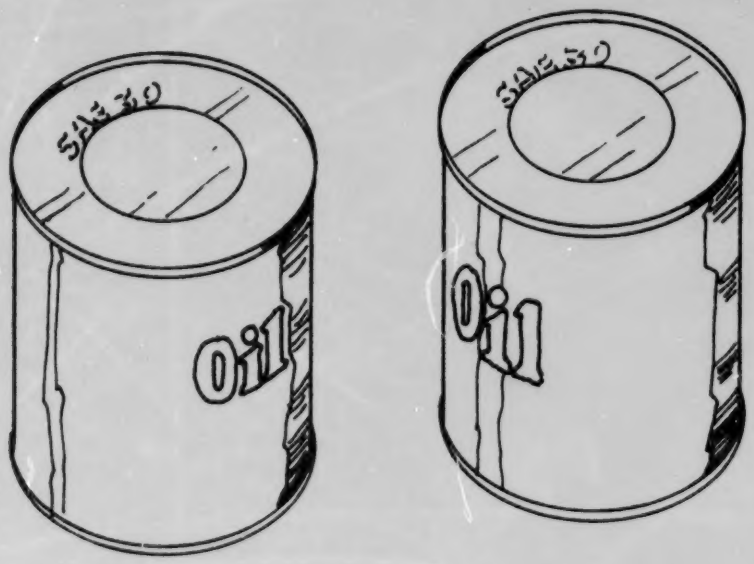
Unit 10
Changing the Oil in a 4-Cycle Engine

A. Tools, Materials and Equipment for Changing the Oil in a 4-Cycle Engine.

1. **CRANKCASE OIL:** Lubricating fluid for internal engine parts. Use type and weight specified by manufacturer.



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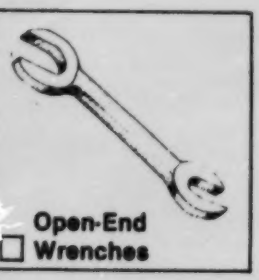
B. Steps for Changing the Oil in a 4-Cycle Engine.

1. Find and Check Off the following:

☐ Operator's Manual

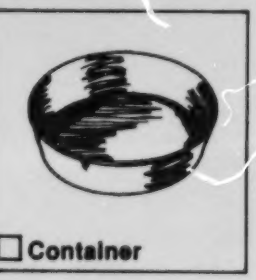
☐ Standard Screwdriver

☐ Pliers


☐ Open-End Wrenches

☐ Flexible-Spout Funnel

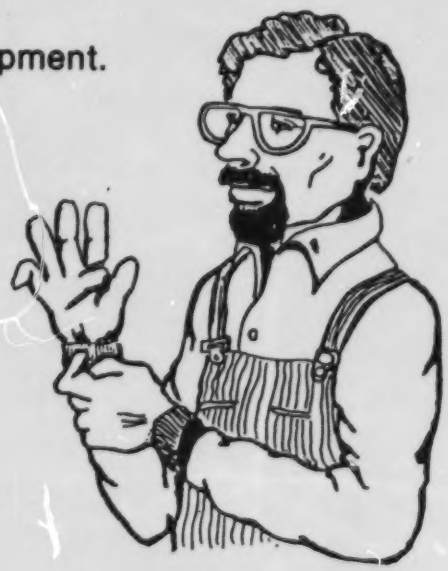
☐ Oil


☐ Container

☐ Shop Towels

☐ Safety Equip.

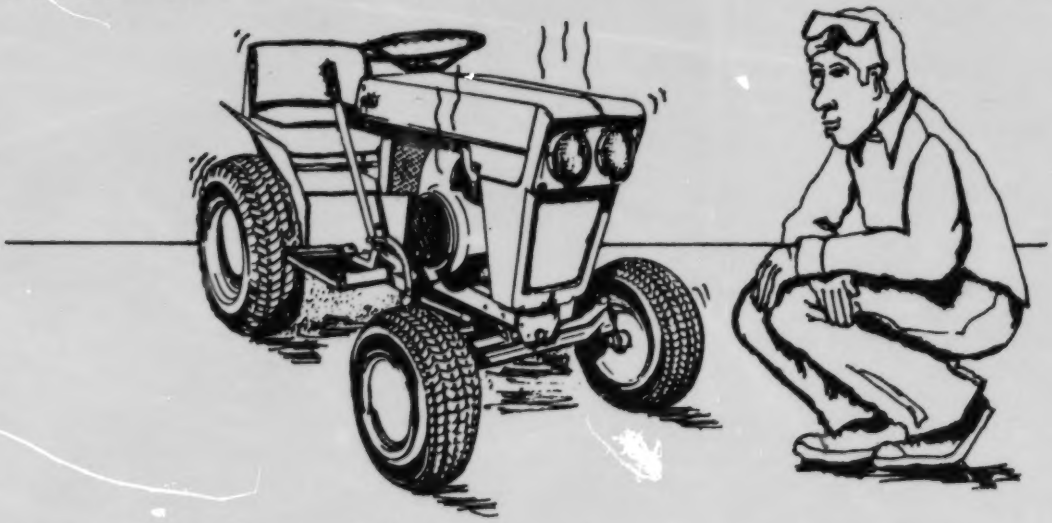
2. Wear proper safety equipment.



NOTE!

Check with your instructor before starting engine.

3. Operate engine until it is warm.

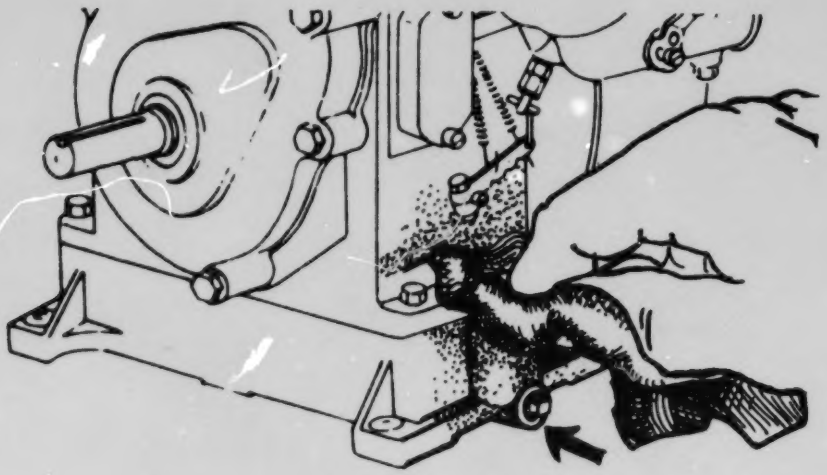


NOTE!

Oil will drain more completely when hot.

4. Stop engine and disconnect spark plug wire.

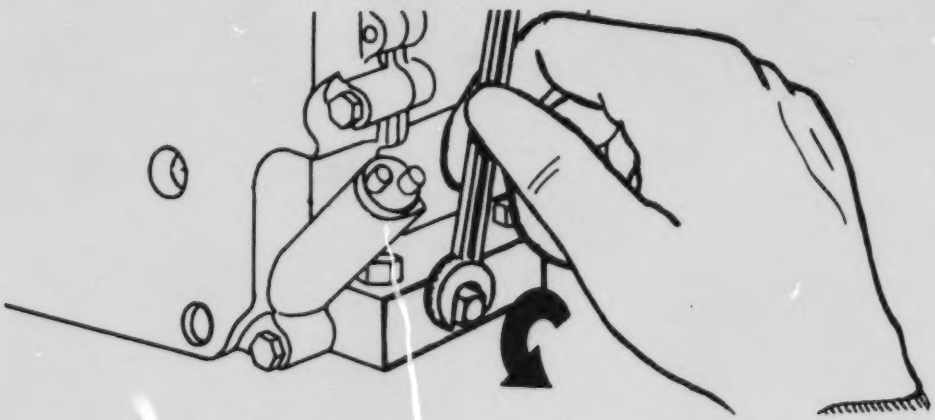
5. Locate drain plug and clean dirt around it.



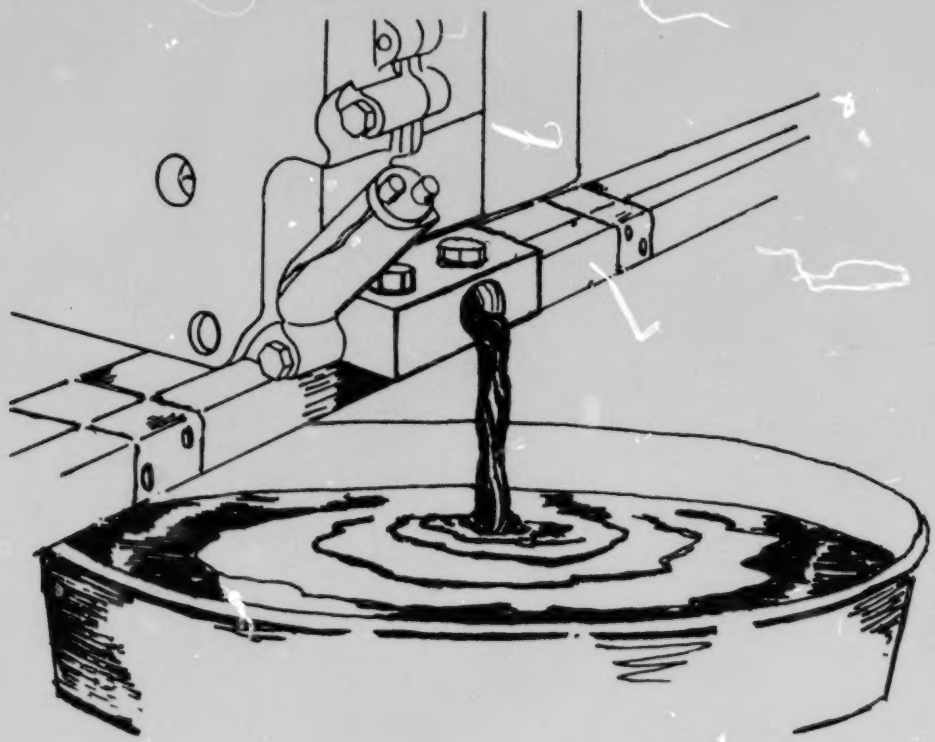
NOTE!

Most drain plugs are located on the outside edge of oil sump. Some engines have no drain plug and are drained through filler neck.

6. Remove drain plug.



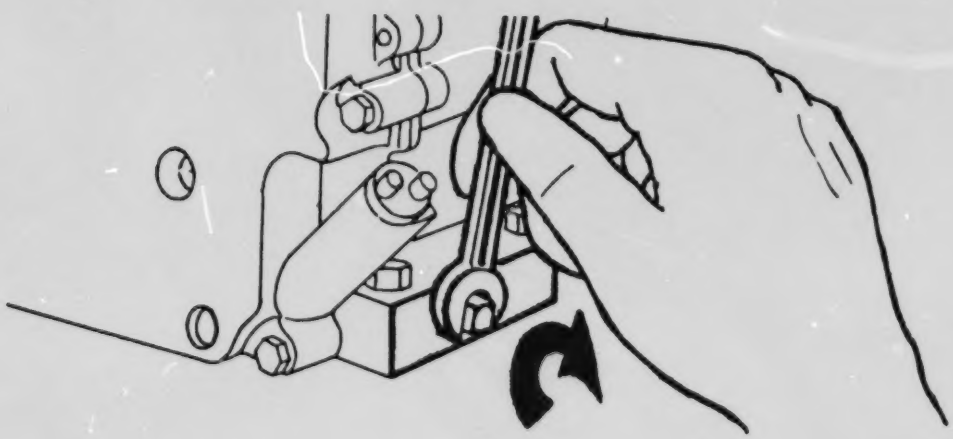
7. Allow crankcase to drain for at least five minutes.



NOTE!

Tilt engine towards drain plug if located on side or top of oil sump.

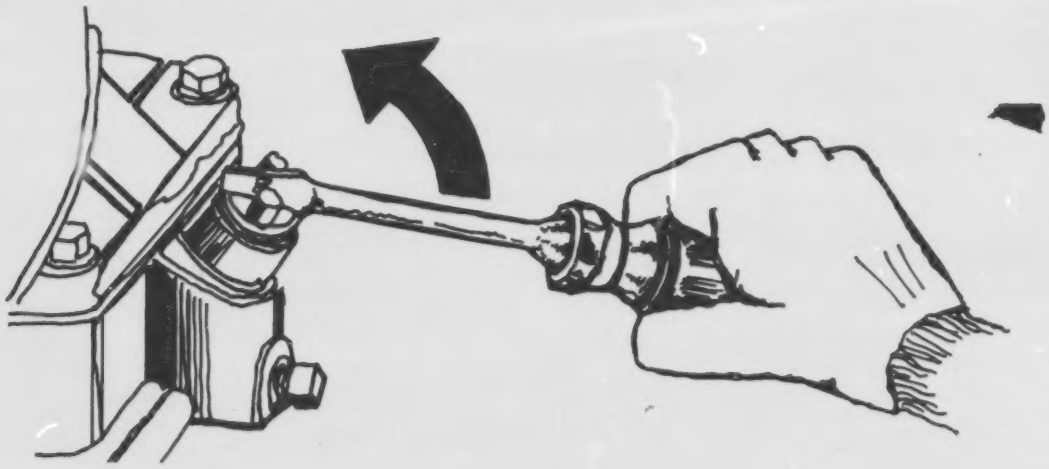
8. Replace and tighten drain plug.



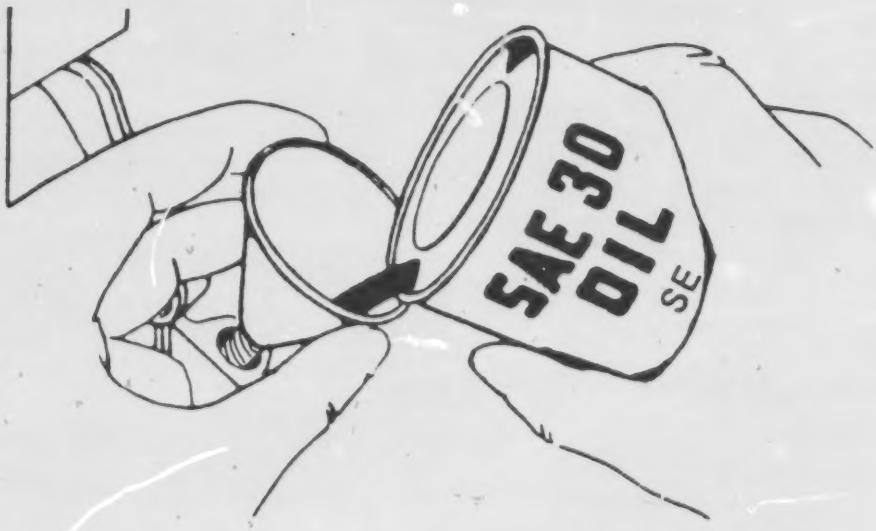
NOTE!

Some drain plugs are equipped with a gasket. Replace it if worn or damaged.

9. Remove filler plug.



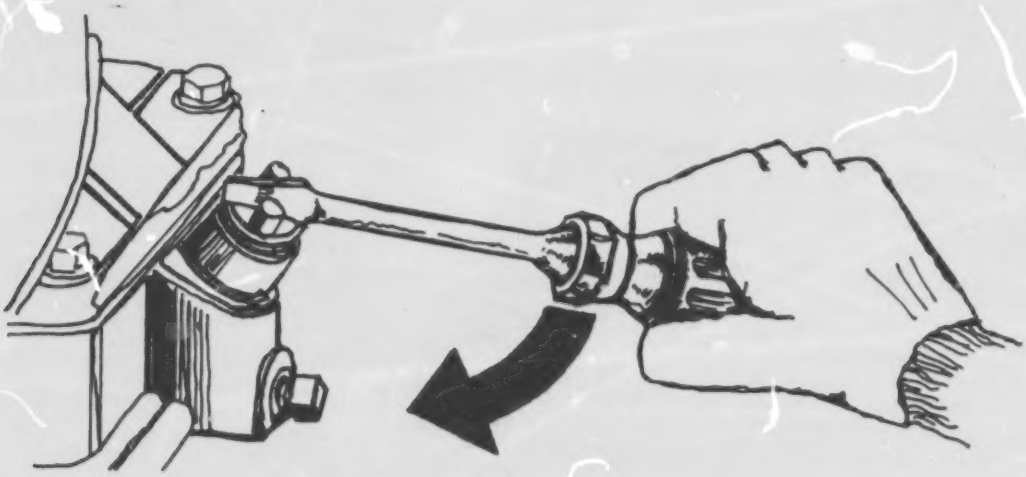
10. Refill crankcase with new oil.



NOTE!

Use type of oil that is recommended in your operator's manual.

11. Replace filler plug.

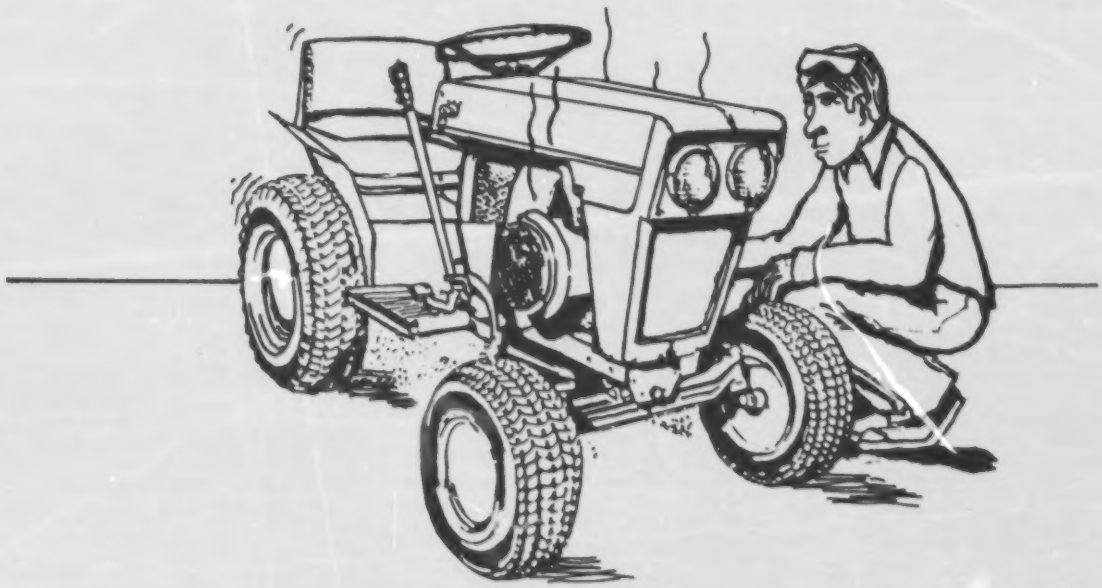


NOTE!

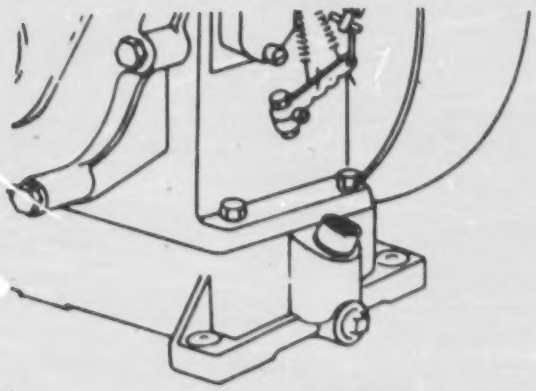
Check with your instructor before starting engine.

12. Connect spark plug wire and start engine.

13. Check for oil leaks.

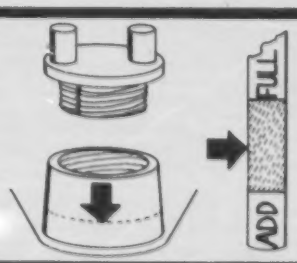


14. Stop engine and recheck oil level. Add more oil if necessary.



NOTE!

On engines with a dipstick, keep oil level between "FULL" and "ADD" lines. Engines without dipsticks are filled to level of filler plug. Do not overfill.



15. Clean your work area and return tools to their proper places.

SEE YOUR INSTRUCTOR

Unit 10
Changing the Oil in a 4-Cycle Engine

Practical Exercise Performance Checklist

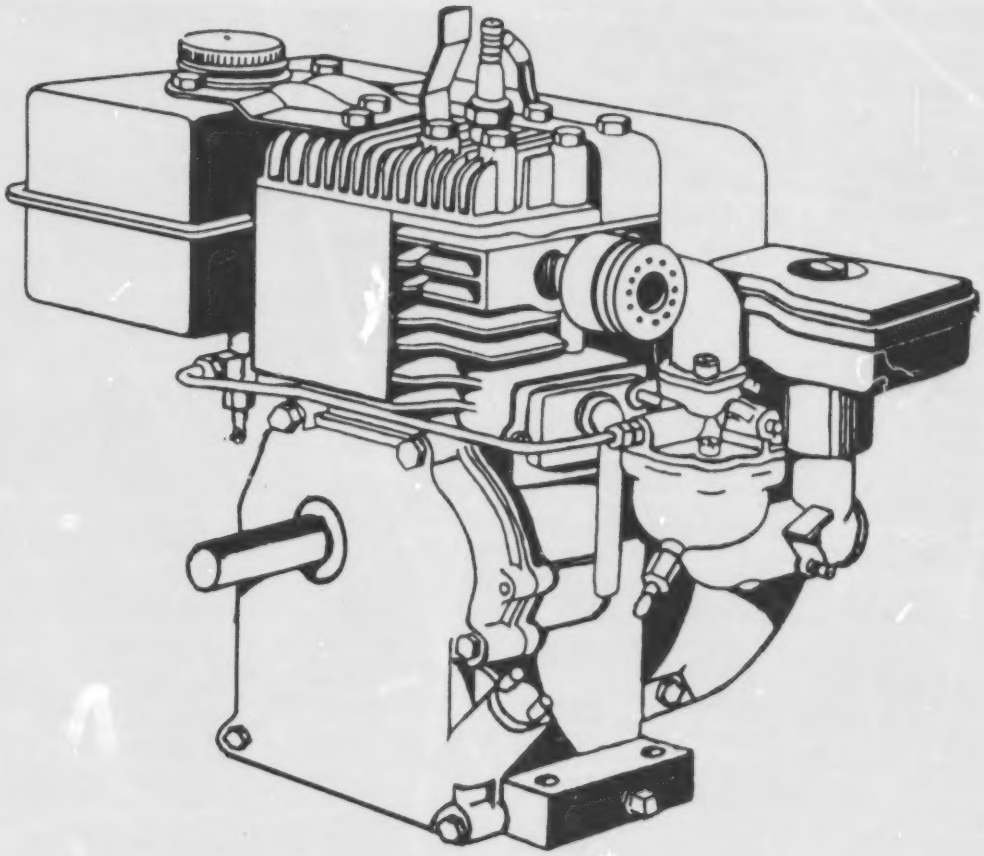
The student_____successfully performed the following tasks:

Tasks	Yes	No	Comments
1. Identified:			
a. Operator's Manual			
b. Standard screwdriver			
c. Combination pliers			
d. Open-end wrench			
e. Flexible-spout funnel			
f. Oil			
g. Container			
h. Shop towels			
2. Wore proper safety equipment			
3. Operated engine until it was warm			
4. Stopped engine and disconnected spark plug wire			
5. Located drain plug and cleaned around it			
6. Removed drain plug			
7. Drained crankcase oil into container			
8. Replaced and tightened drain plug			
9. Removed filler plug			
10. Refilled crankcase with oil			
11. Replaced filler plug			
12. Reconnected spark plug wire and started engine			
13. Checked engine for oil leaks			
14. Stopped engine and rechecked oil level			
15. Cleaned work area and returned tools to their proper places			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 11

Checking the Carburetor for Proper Operation

PRACTICAL ARTS AND VOCATIONAL-TECHNICAL EDUCATION
IML
INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 11
Checking the Carburetor for Proper Operation

Checking the Carburetor for Proper Operation

After you study this lesson, you should be able to:

1. Identify tools and materials used in checking the carburetor.
2. Determine if carburetor is functioning properly.

Show What You Can Do.

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

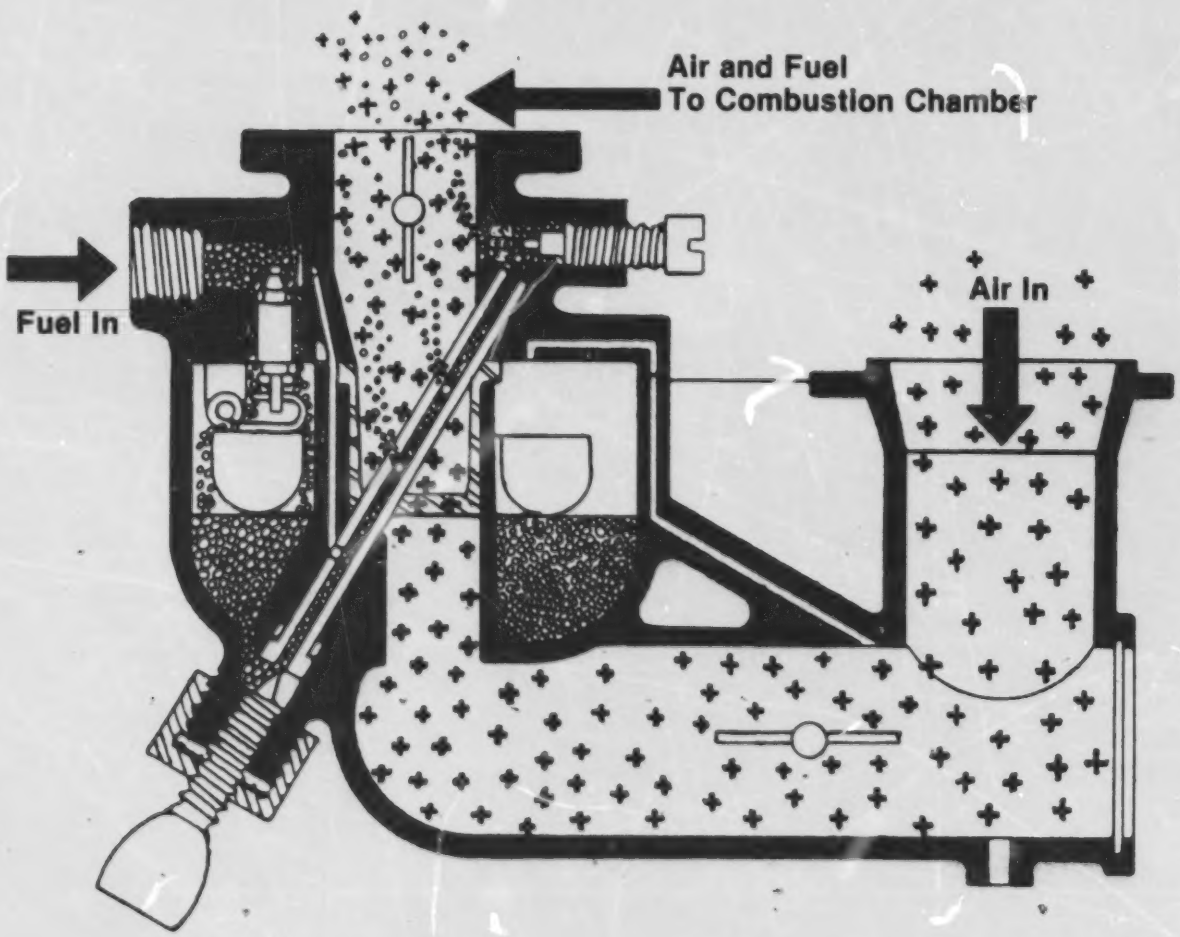
TURN THE PAGE AND BEGIN

Unit 11
Checking the Carburetor for Proper Operation

Introduction

Small engines cannot operate well without a properly adjusted carburetor. Basically a carburetor has three main functions. It breaks up fuel into a fine spray, properly mixes fuel with air, and regulates amount of fuel/air mixture into combustion chamber.

In this unit you will learn to check the carburetor for proper operation.



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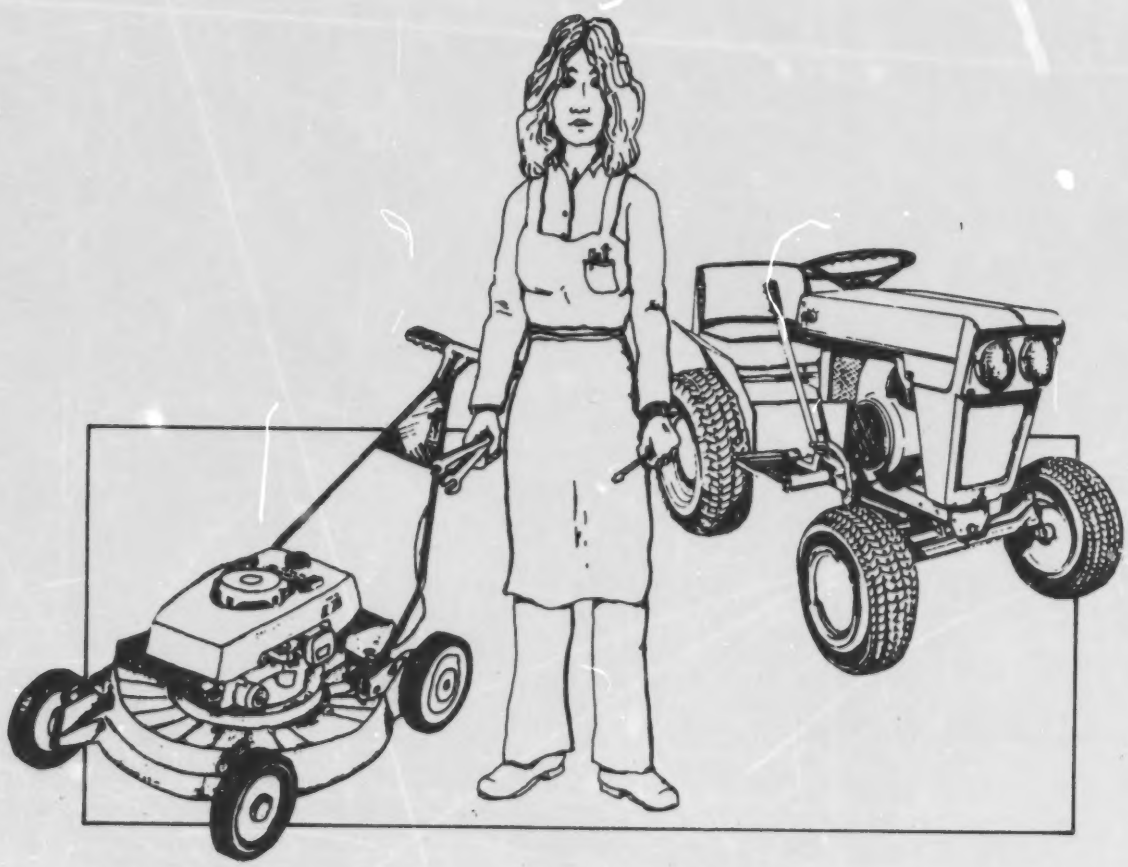
Unit 11
Checking the Carburetor for Proper Operation

A. Tools, Materials and Equipment for Checking the Carburetor for Proper Operation.

You have already used all tools and equipment for checking the carburetor for proper operation.



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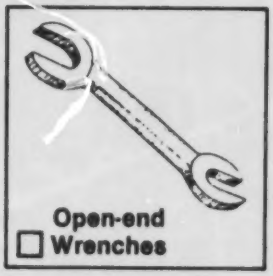
B. Steps in Checking the Carburetor for Proper Operation.

1. Find and Check Off the following:

☐ Standard Screwdriver

☐ Phillips Screwdriver


☐ Open-end Wrenches

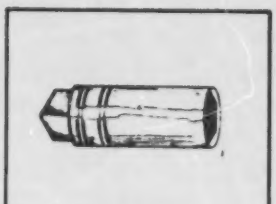
☐ Operator's Manual

☐ Needle-nose Pliers

☐ Container of Gas

☐ Spark Tester

☐ Socket Wrench


☐ Spark Plug Socket

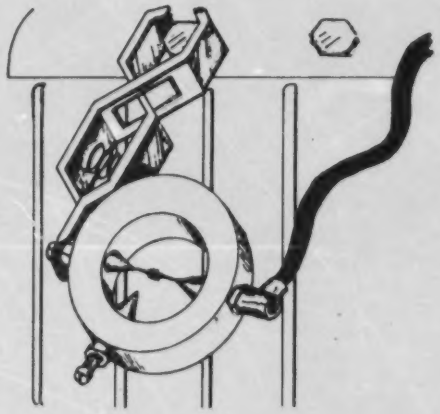
☐ Shop Towels

☐ Safety Equipment

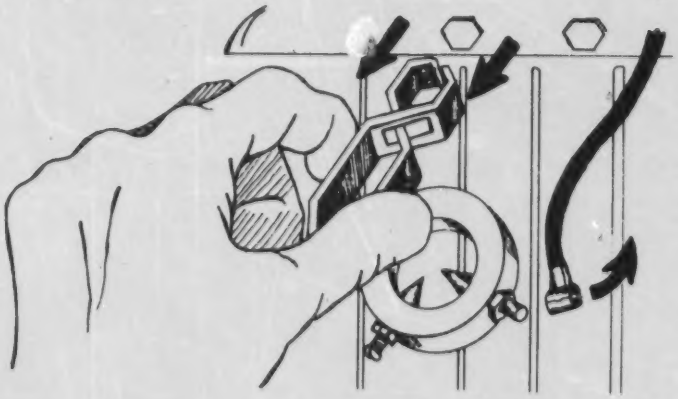
2. Wear proper safety equipment.

3. Read your operator's manual.

4. Remove spark plug, attach the spark tester, and check spark.



5. Remove spark tester.



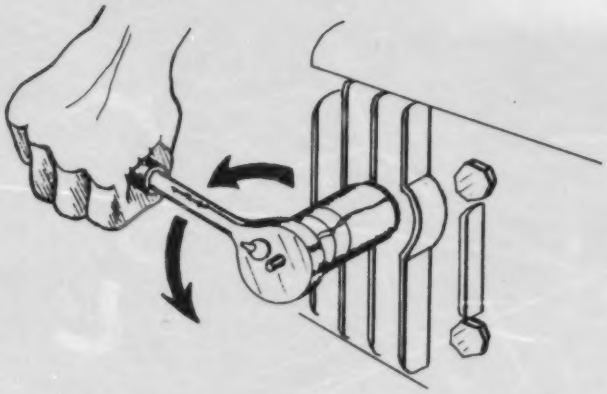
6. Check with your instructor before starting engine.

7. Replace spark plug, start engine, and check spark.

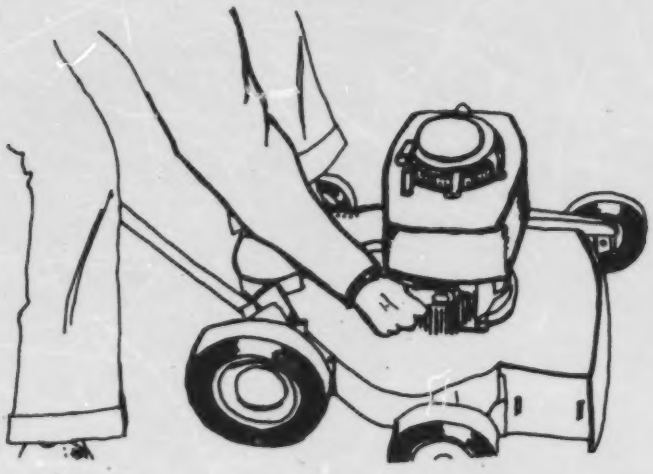
NOTE!

Remember you are checking for carburetor trouble. If engine does not start and you have a strong spark at the spark tester, the ignition is working properly.

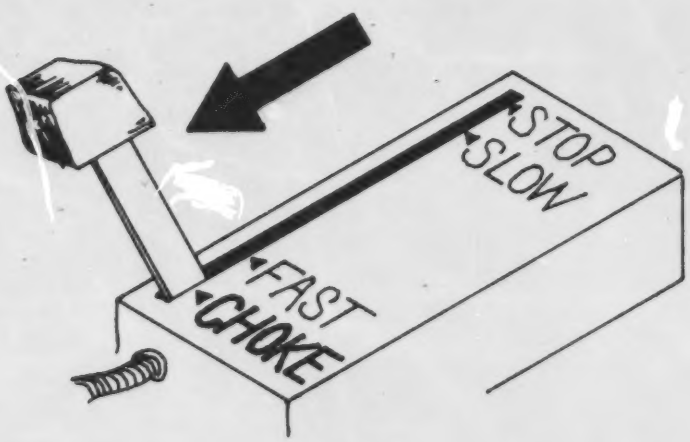
8. Stop engine and remove spark plug.



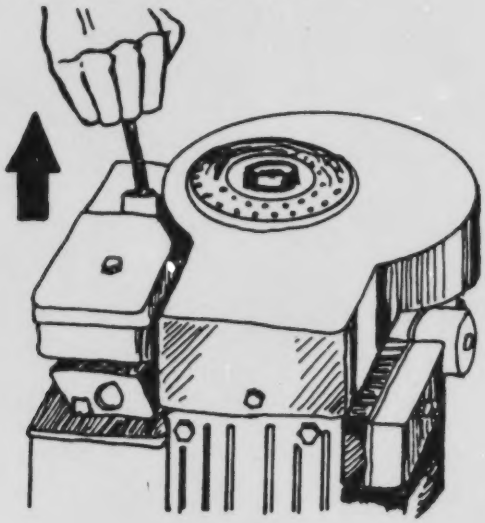
9. Place your thumb over spark plug hole.



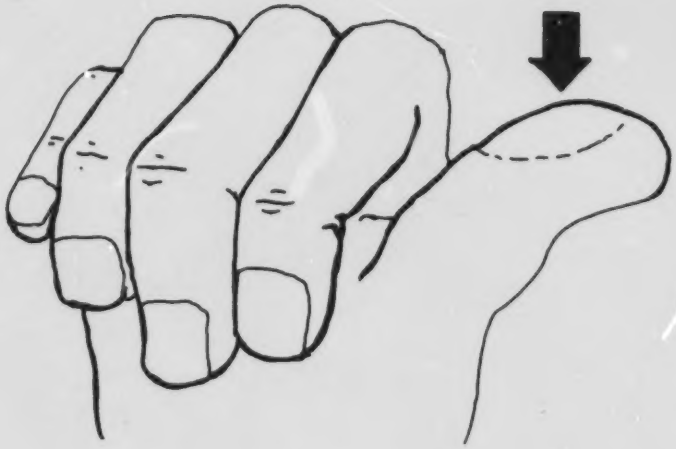
10. Close choke valve.



11. Crank engine with starter 3 or 4 times.



12. Remove your thumb.

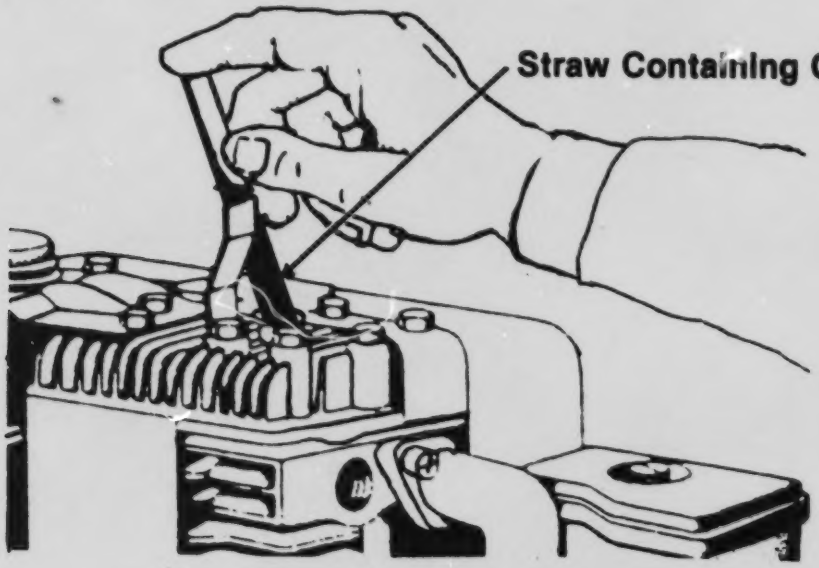


NOTE!

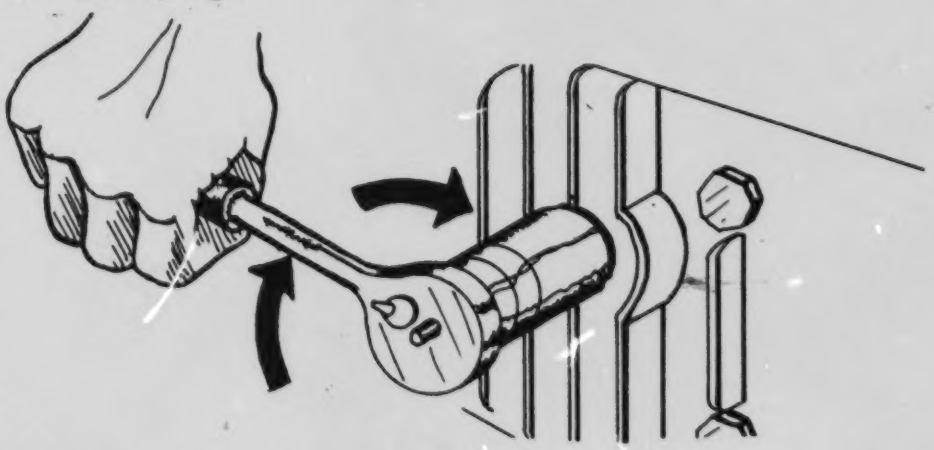
If your thumb is wet, the starting trouble is not the carburetor unless it is flooding.

If your thumb is not wet, no fuel is getting to the combustion chamber.

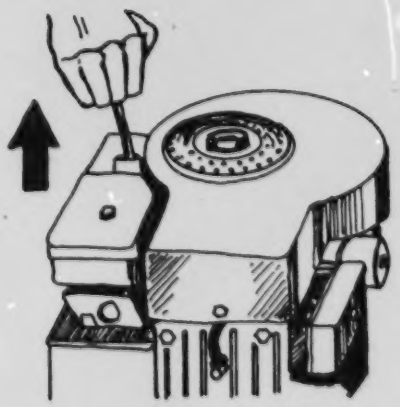
13. Put one-half teaspoon of gasoline into combustion chamber through the spark plug hole.



14. Replace spark plug.



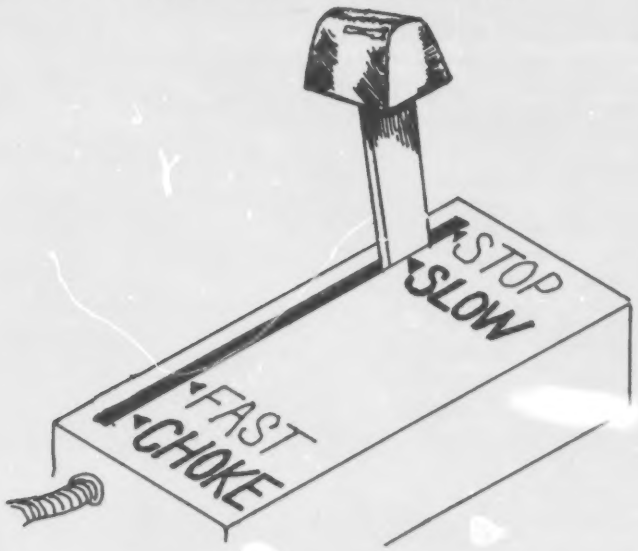
15. Start engine again.



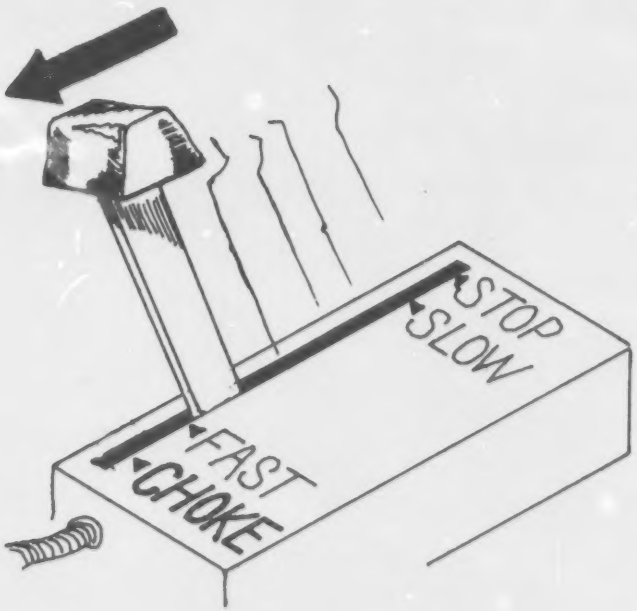
NOTE!

If engine does not start, proceed to the next unit.

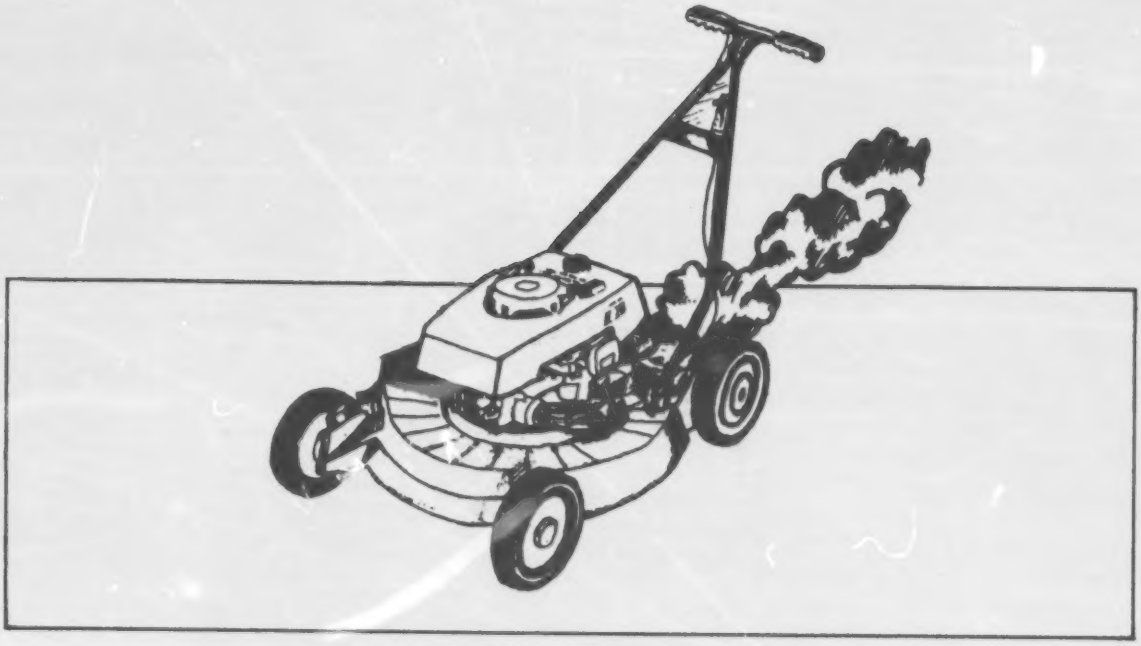
16. Operate engine at idling speed for warm up.



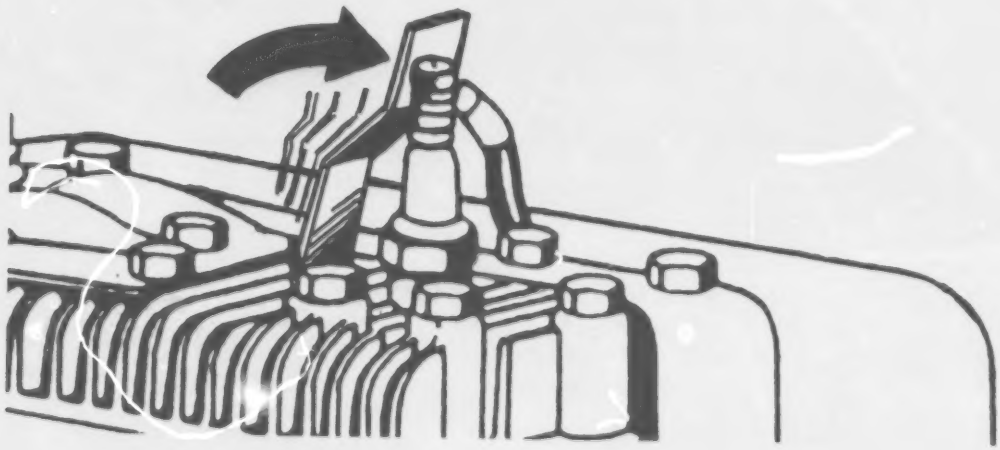
17. Advance the throttle suddenly. Engine should accelerate smoothly.



18. Check the exhaust smoke. If engine gives off black smoke, the fuel mixture is too rich.



19. Stop the engine.



20. Clean your work area and return tools to their proper places.

SEE YOUR INSTRUCTOR

Unit 11
Checking the Carburetor for Proper Operation

Practical Exercise Performance Checklist

The student _____ successfully performed the following tasks:

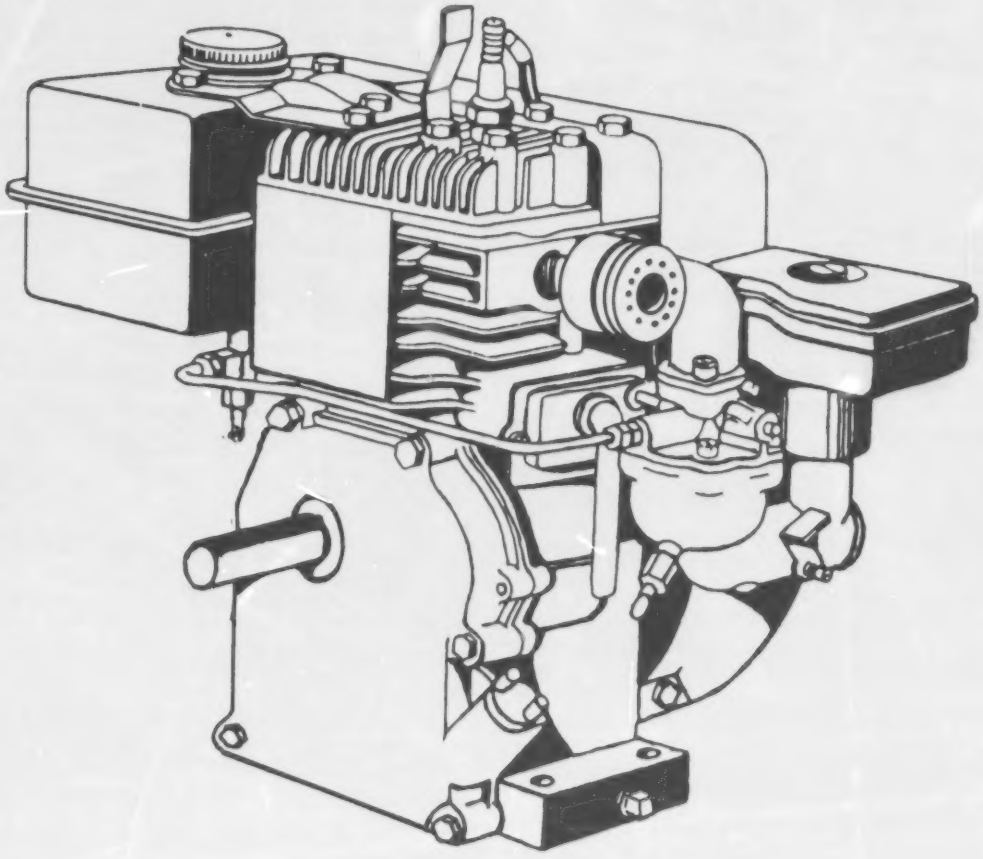
Tasks	Yes	No	Comments
1. Identified:			
a. Standard screwdriver			
b. Phillips screwdriver			
c. Open-end wrench			
d. Needle-nose pliers			
e. Operator's manual			
f. Container of gasoline			
g. Shop towels			
h. Spark tester			
i. Safety equipment			
j. Socket wrench			
k. Spark plug socket			
2. Wore proper safety equipment			
3. Read your operator's manual			
4. Removed spark plug, attached spark tester, and checked spark			
5. Removed spark tester			
6. Checked with instructor before starting engine			
7. Replaced spark plug, started engine, and checked spark			
8. Stopped engine and removed spark plug			
9. Placed thumb over spark plug hole			
10. Closed choke valve			
11. Cranked engine with starter 3 or 4 times			
12. Removed thumb from spark plug hole			

Tasks	Yes	No	Comments
13. Placed one-half teaspoon of gas into combustion chamber			
14. Replaced spark plug			
15. Restarted engine			
16. Operated engine at idling speed for warm up			
17. Advanced throttle suddenly			
18. Checked exhaust smoke			
19. Stopped engine			
20. Cleaned work area and returned tools to their proper places			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

Instructor's Signature _____ Date _____

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 12

Preparing for Carburetor Adjustment

PRACTICAL ARTS AND VOCATIONAL TECHNICAL EDUCATION
IML
INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 12
Preparing for Carburetor Adjustment

Preparing for Carburetor Adjustment

After you study this lesson, you should be able to:

1. Identify tools and materials used in preparing for carburetor adjustment.
2. Check and identify steps for carburetor adjustments.

Show What You Can Do.

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

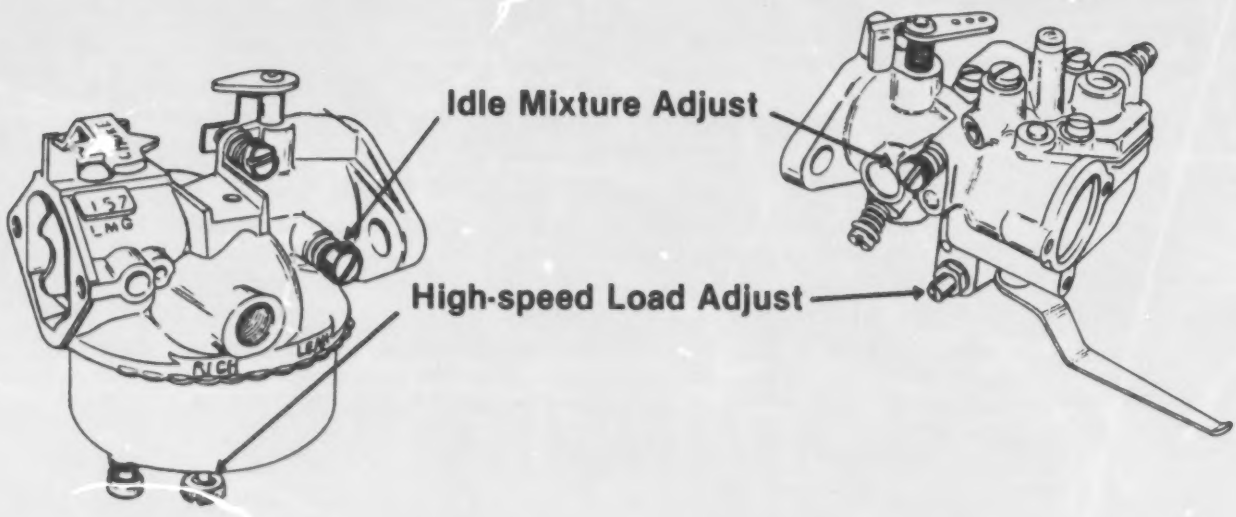
☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

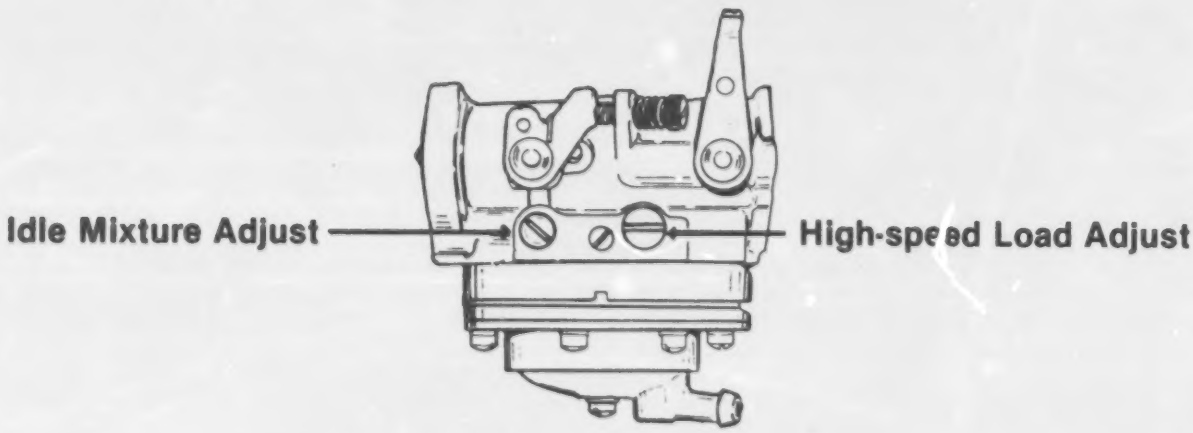
TURN THE PAGE AND BEGIN

Unit 12
Preparing for Carburetor Adjustment

Introduction

You have learned how to check the carburetor to see if it is operating properly. In this unit you will be learning how to identify different types of carburetors and adjustments to make on the carburetor.





TURN TO NEXT PAGE

Unit 12
Preparing for Carburetor Adjustment

A. Tools, Materials and Equipment needed in Preparing for Carburetor Adjustment.

You have already used all the tools and equipment necessary to complete this unit.

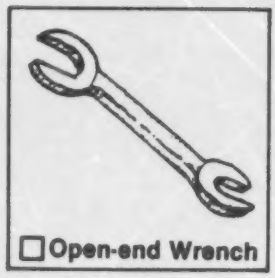
TURN TO NEXT PAGE

B. Steps in Preparing For Carburetor Adjustment.

1. Find and Check Off the following:

☐ Standard Screwdriver

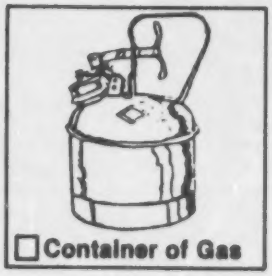
☐ Phillips Screwdriver



☐ Open-end Wrench

☐ Operator's Manual

☐ Long-nose Pliers



☐ Container of Gas

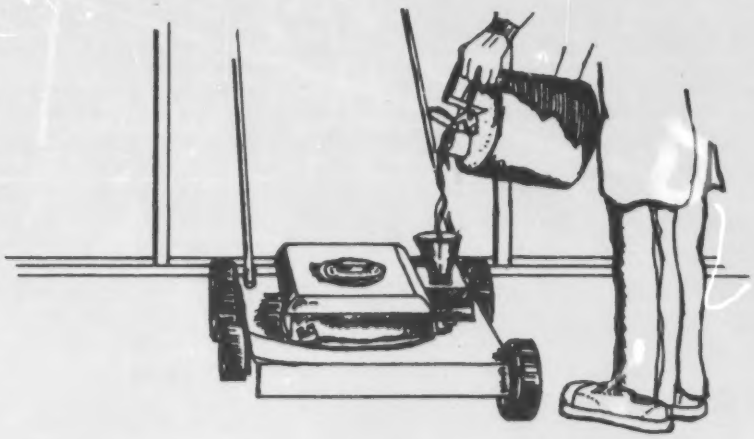
☐ Shop Towels

☐ Safety Equip.

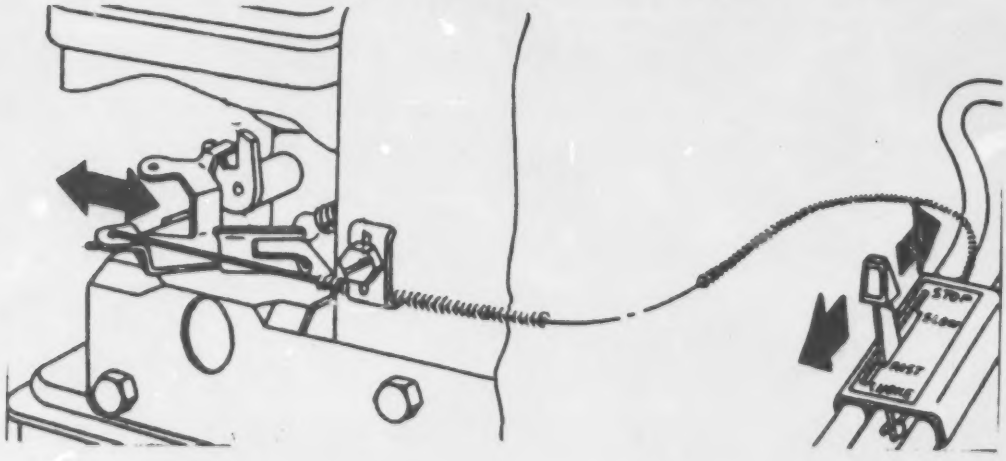
2. Wear proper safety equipment.

3. Read operator's manual.

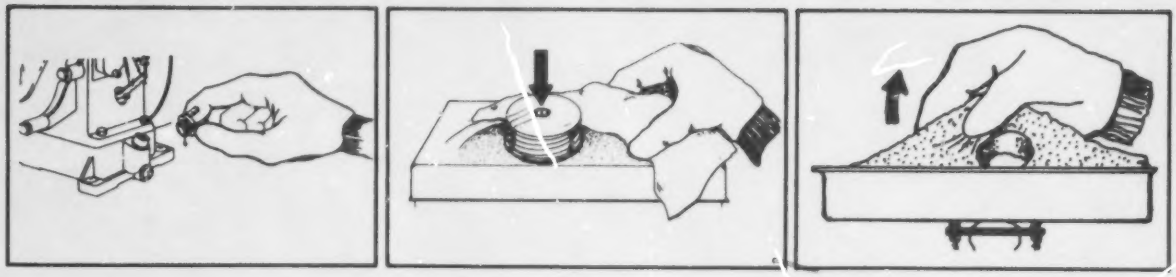
el tank with clean, fresh gasoline.



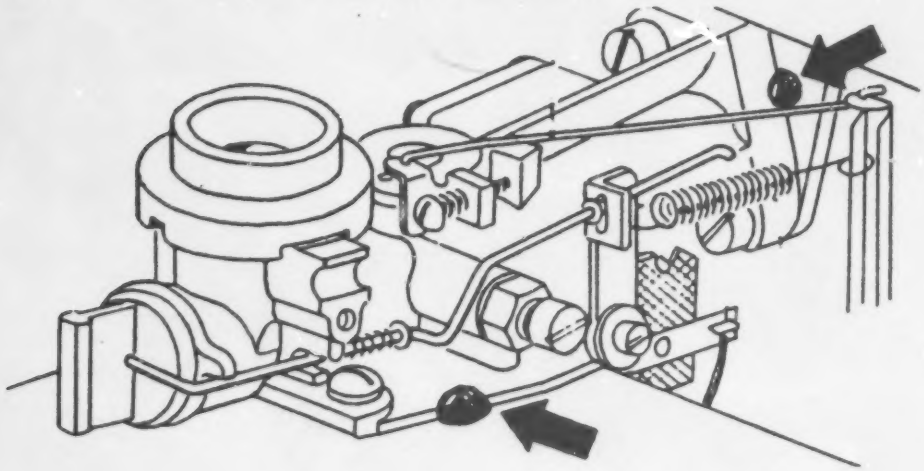
5. Check the throttle linkage for good working conditions.



6. Service the engine.
   - ☐Check the crankcase oil level
   - ☐Check the fuel-tank vent
   - ☐Service fuel and air cleaner



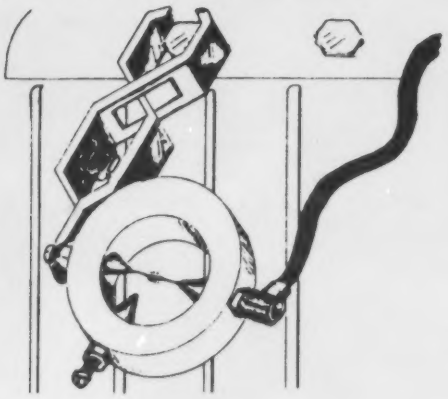
7. Check for air leaks in carburetor manifold.



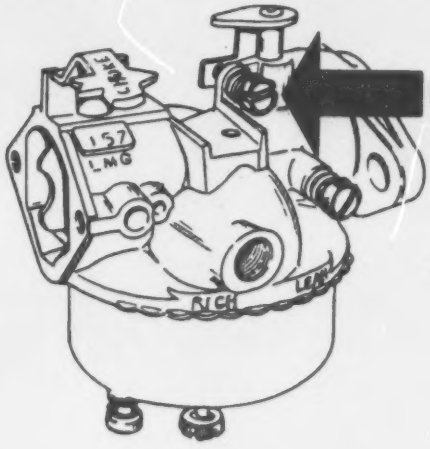
NOTE!

If you suspect a leak put a drop of oil on that area, crank engine, and see if oil disappears. If it does, you have an air leak. Tighten screws and recheck.

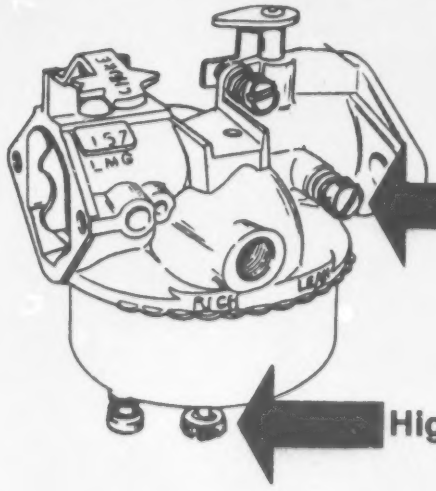
8. Check for poor ignition which can cause false carburetion.



9. Locate the idle-speed stop screw on the carburetor. The stop screw limits the travel of the throttle valve.



10. Locate and identify fuel-air mixture adjusting screws.



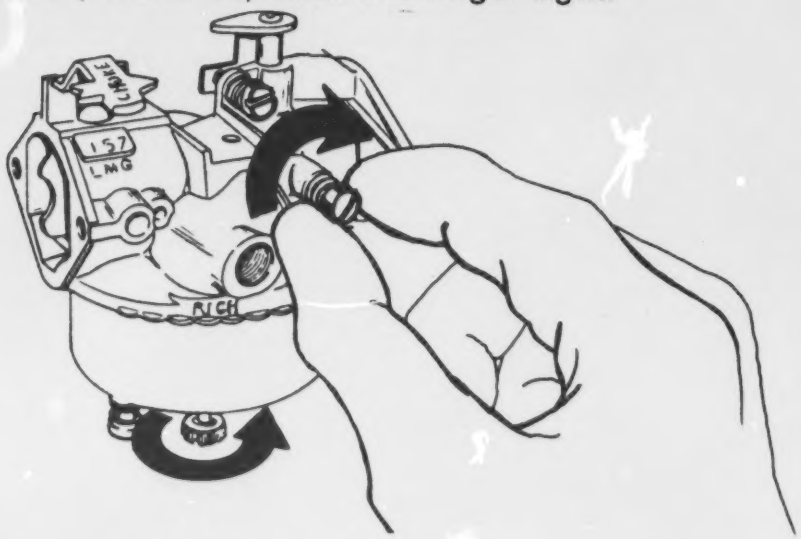
NOTE!

Most older carburetors will have an idle-mixture adjustment and a high-speed adjustment screw.

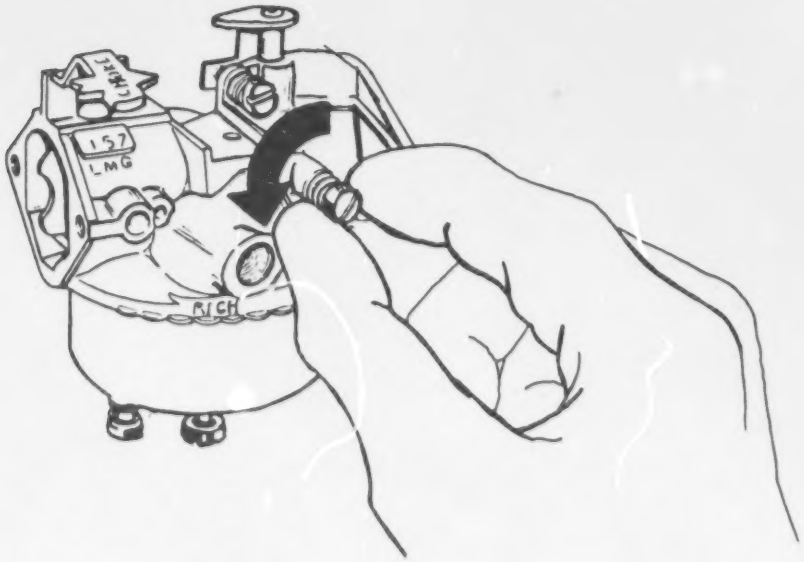
New Models have no adjustments.

Check operator's manual for type you have.

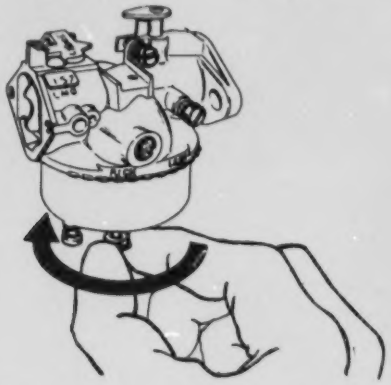
11. To adjust the carburetor, turn each adjusting needle all the way in by hand (clockwise) until it is finger tight.



12. Open the idle needle 3/4 of a turn counterclockwise.



13. Open high-speed needle 1½ turns counterclockwise.

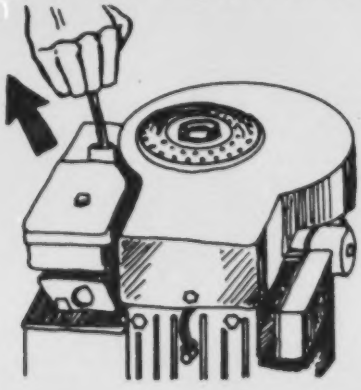


NOTE!

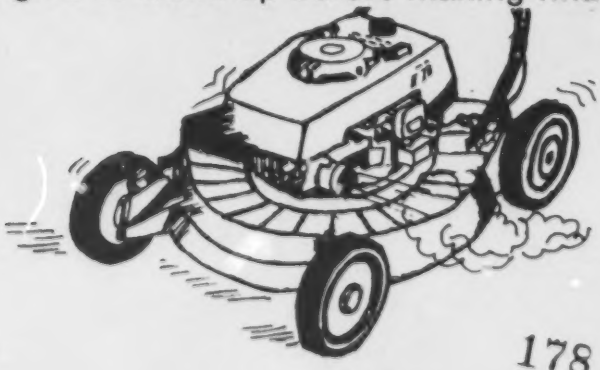
With this your engine should start and run. Final adjustment will be made when engine is running.

Check with your instructor before starting engine.

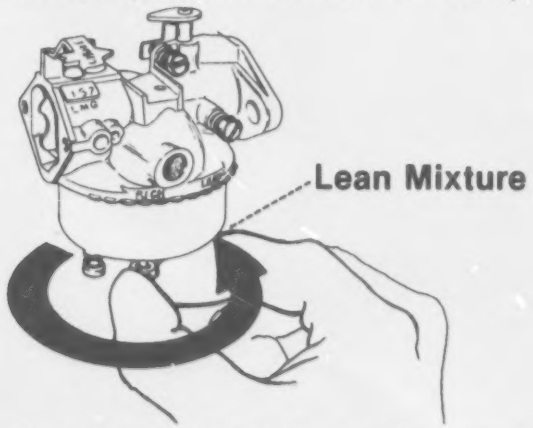
14. Start engine to make final adjustments.



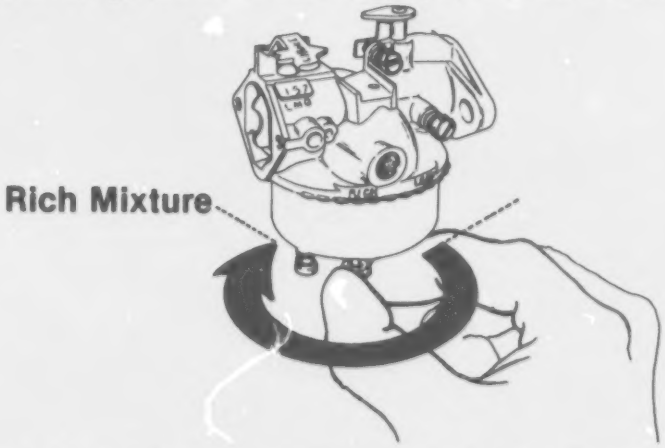
15. Allow engine to warm up before making final adjustments.



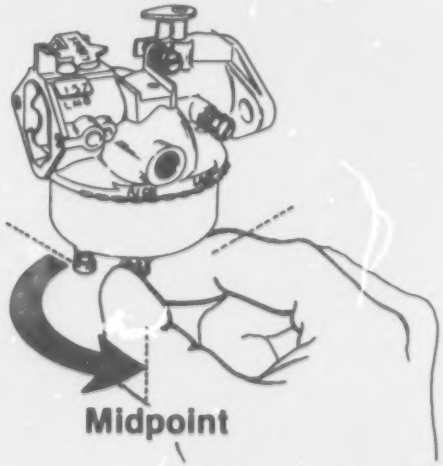
16. For final adjustments on carburetor, turn high-speed needle valve in until engine misses. (You have a lean mixture).



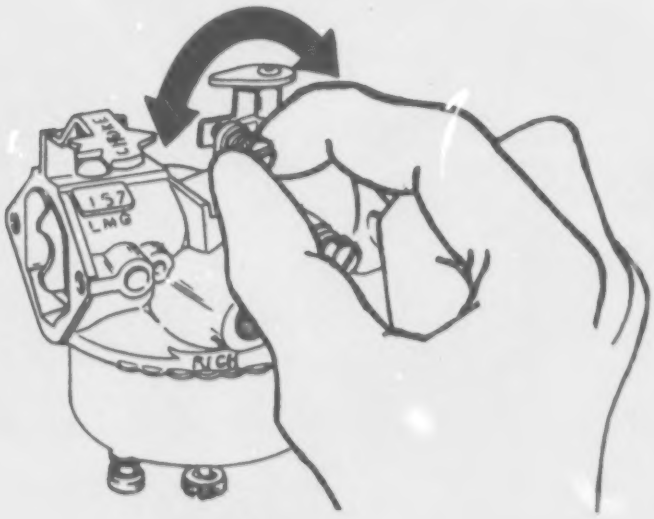
17. Turn high-speed needle valve out past a smooth operating point until engine runs unevenly. (You have a rich mixture).



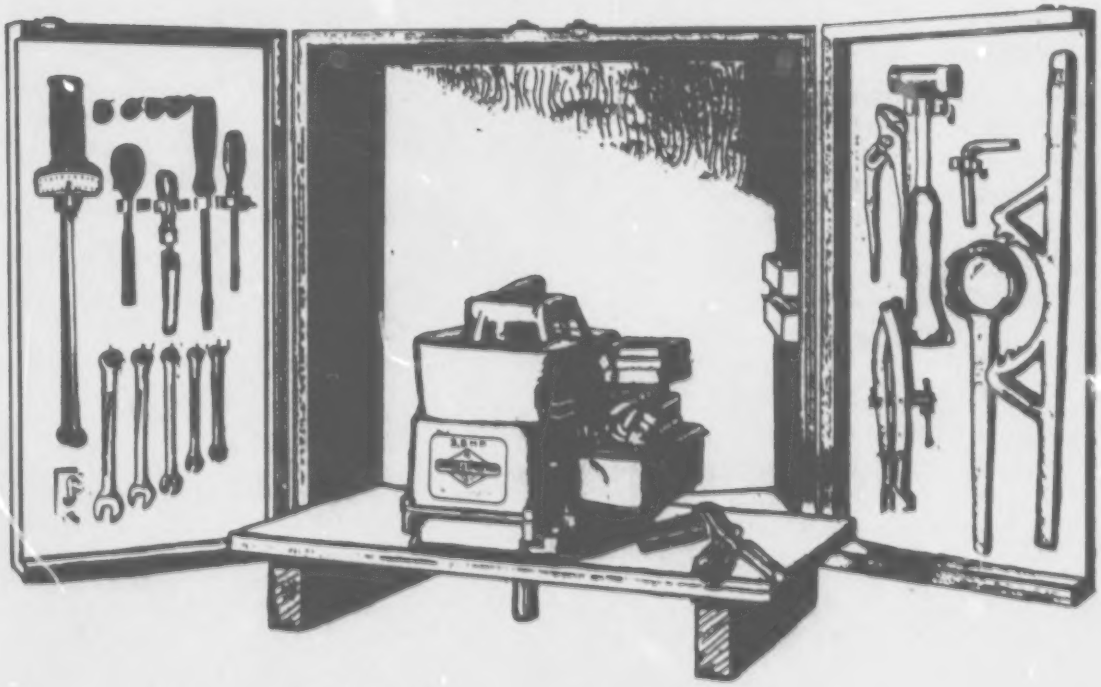
18. Turn high-speed needle valve to a midpoint between rich and lean mixture so engine will run smoothly.



19. Turn idle speed adjusting screw until engine is running smoothly and quietly.



20. Clean your work area and return tools to their proper places.



SEE YOUR INSTRUCTOR

Unit 12
Preparing For Carburetor Adjustment

Practical Exercise Performance Checklist

The student_____successfully performed the following tasks:

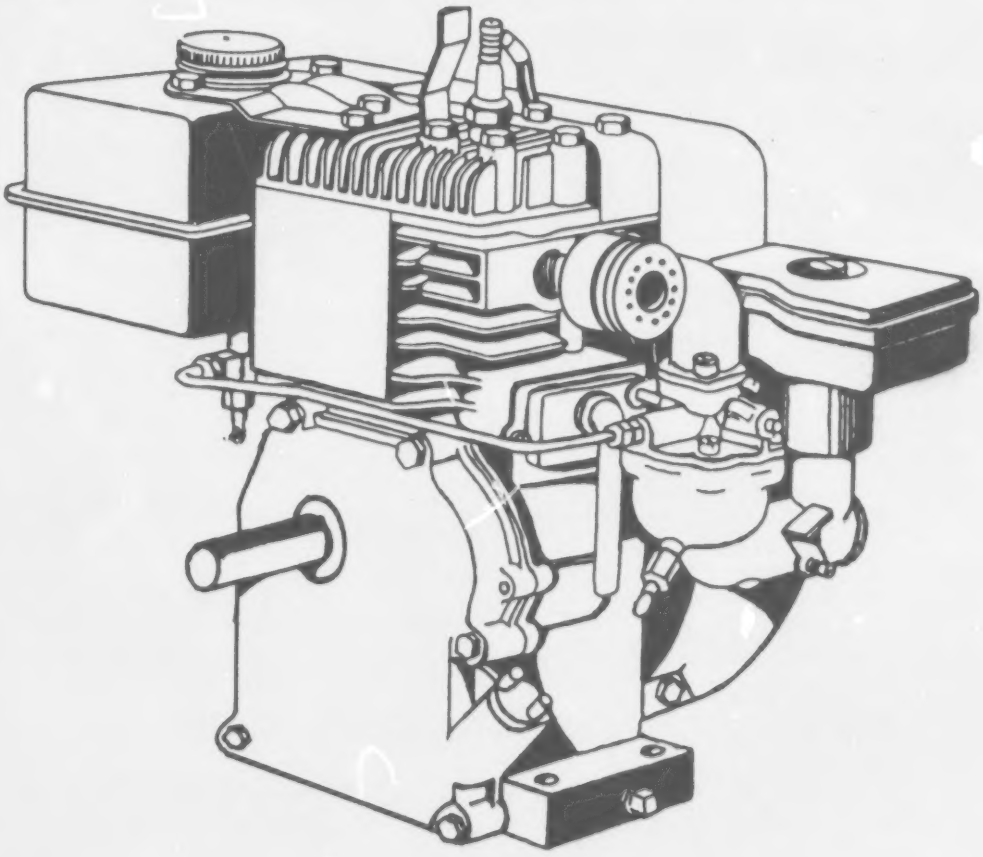
Tasks	Yes	No	Comments
1. Identified:			
a. Standard screwdriver			
b. Phillips screwdriver			
c. Open-end wrench			
d. Long-nose pliers			
e. Operator's manual			
f. Shop towels			
g. Container of gas			
h. Safety equip.			
2. Wore proper safety equipment			
3. Read operator's manual			
4. Filled fuel tank with clean, fresh gasoline			
5. Checked throttle linkage for good working conditions			
6. Checked crankcase oil level			
7. Checked fuel tank vent			
8. Serviced fuel and air filters			
9. Checked for air leaks in carburetor manifold			
10. Checked ignition			
11. Located idle speed stop screw on carburetor			
12. Located fuel-air mixture adjusting screws on carburetor			
13. Turned each adjusting needle all the way in			

Tasks	Yes	No	Comments
14. Opened idle needle ¾ turn			
15. Opened high-speed needle 1½ turns			
16. Started engine to make final adjustments			
17. Allowed engine to warm up before making final adjustments			
18. Turned high-speed needle in until engine missed			
19. Turned high-speed needle out until engine ran unevenly			
20. Turned high-speed needle to midpoint between lean and rich mixture			
21. Turned idle speed adjusting screw until engine ran smoothly and quietly			
22. Cleaned work area and returned tools to their proper places			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 13

Adjusting the Carburetor Choke

PRACTICAL ARTS AND VOCATIONAL-TECHNICAL EDUCATION
INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 13
Adjusting the Carburetor Choke

Adjusting the Carburetor Choke

After you study this lesson, you should be able to:

1. Identify tools and materials used in adjusting the carburetor choke.
2. Identify and adjust the carburetor choke.

Show What You Can Do.

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

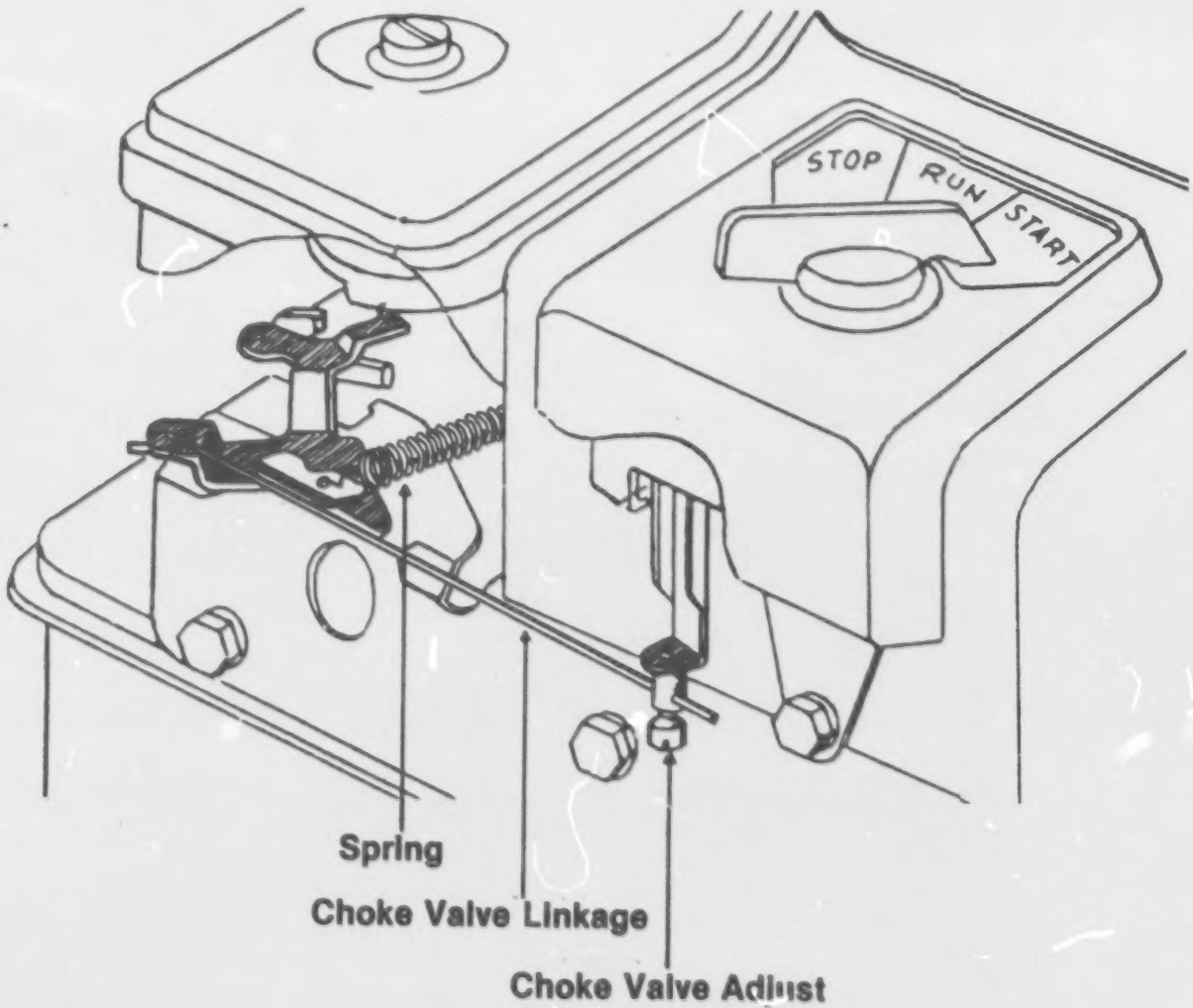
☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

TURN THE PAGE AND BEGIN

Unit 13
Adjusting the Carburetor Choke

Introduction

This unit will introduce you to a method of how to properly adjust a manual choke. Adjustment of the choke is usually limited to adjustment of choke-valve linkage and adjustment of spring tension.



TURN TO NEXT PAGE

Unit 13
Adjusting the Carburetor Choke

A. Tools, Materials and Equipment for Adjusting the Carburetor Choke.

You have already used all the tools and equipment necessary to complete this unit.

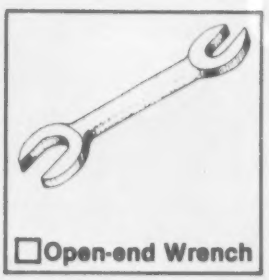
TURN TO NEXT PAGE

B. Steps in Adjusting the Carburetor Choke.

1. Find and Check Off the following:

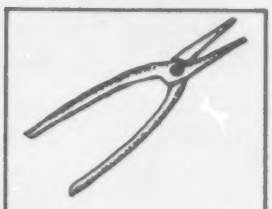
☐ Standard Screwdriver

☐ Phillips Screwdriver



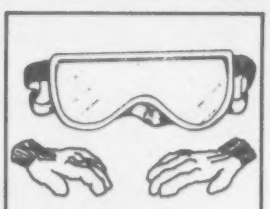
☐ Open-end Wrench

☐ Operator's Manual



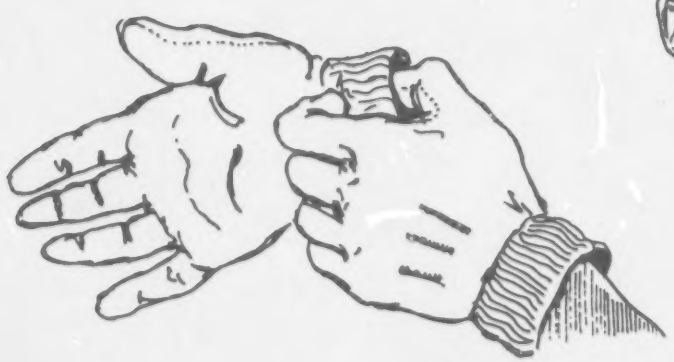
☐ Long-nose Pliers

☐ Shop Towels



☐ Safety Equip.

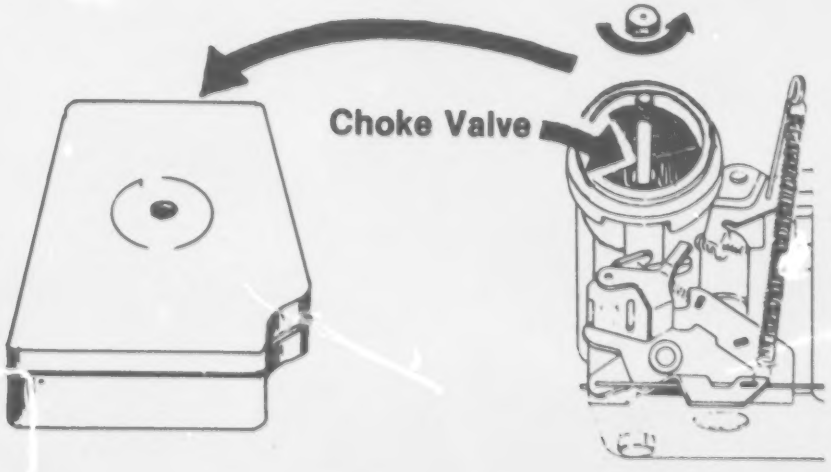
2. Wear proper safety equipment.



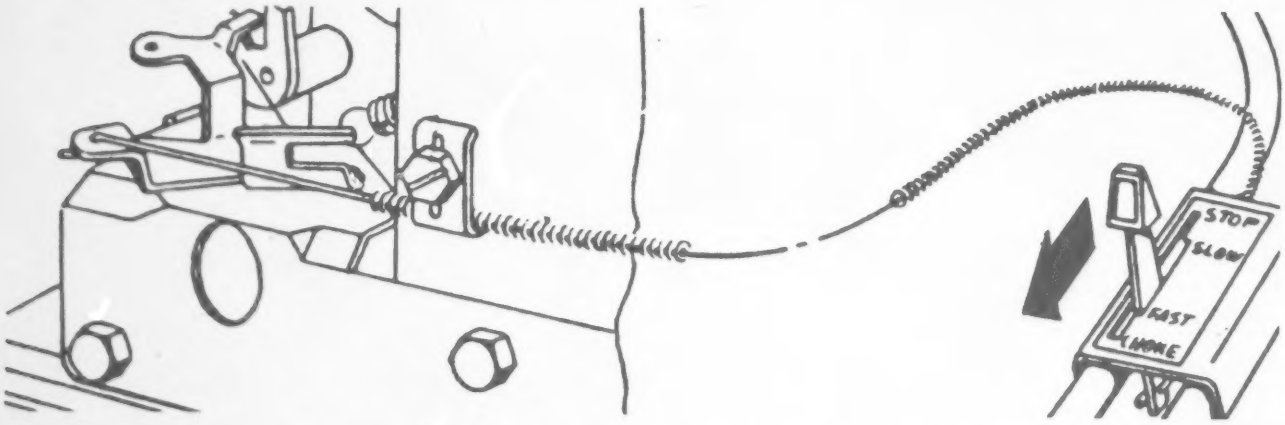
3. Read operator's manual.

4. Pull spark-plug wire.

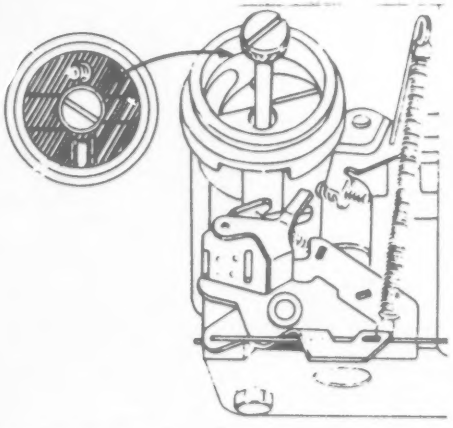
5. Remove carburetor air cleaner. This enables you to see choke-valve position.



6. Close choke valve with throttle control. Check for freedom of operation.



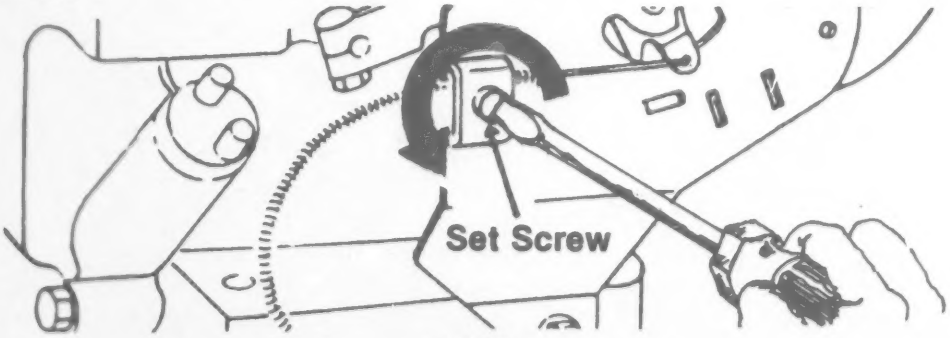
7. Observe position of the choke valve after closing throttle control.



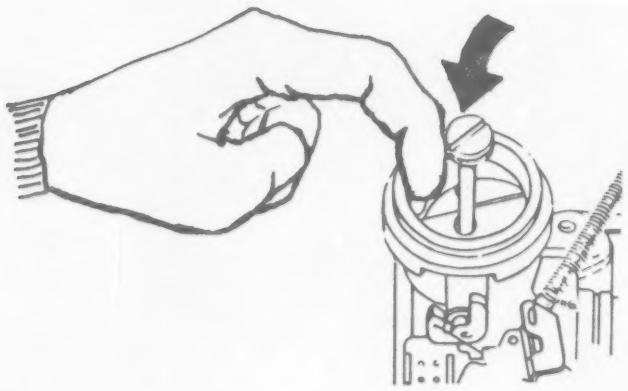
NOTE!

This area must be closed entirely when control lever is placed in "start" or "choke" position.

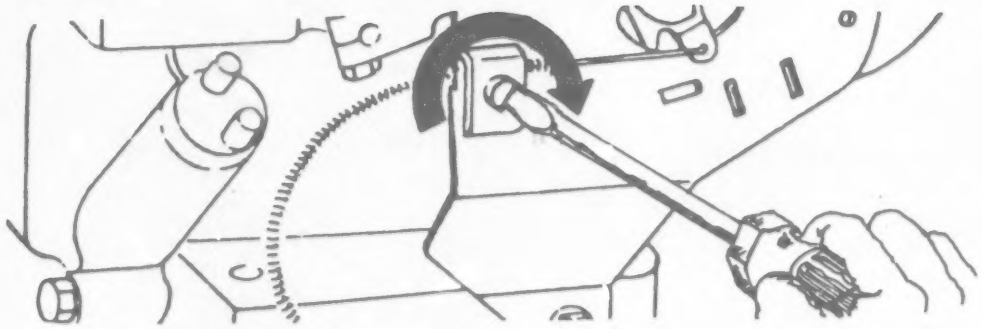
8. To adjust control linkage, loosen the set screw holding the linkage.



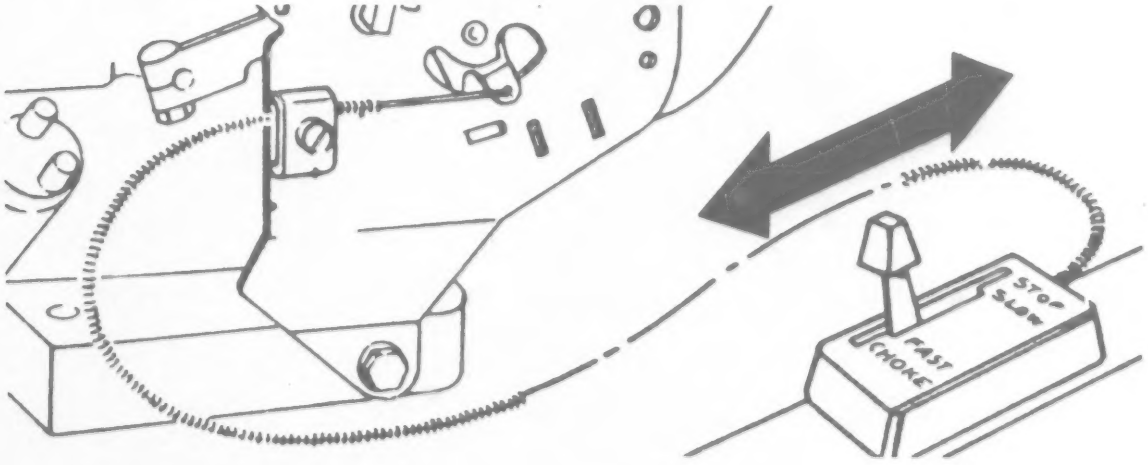
9. Close the choke valve.



10. Tighten set screw.

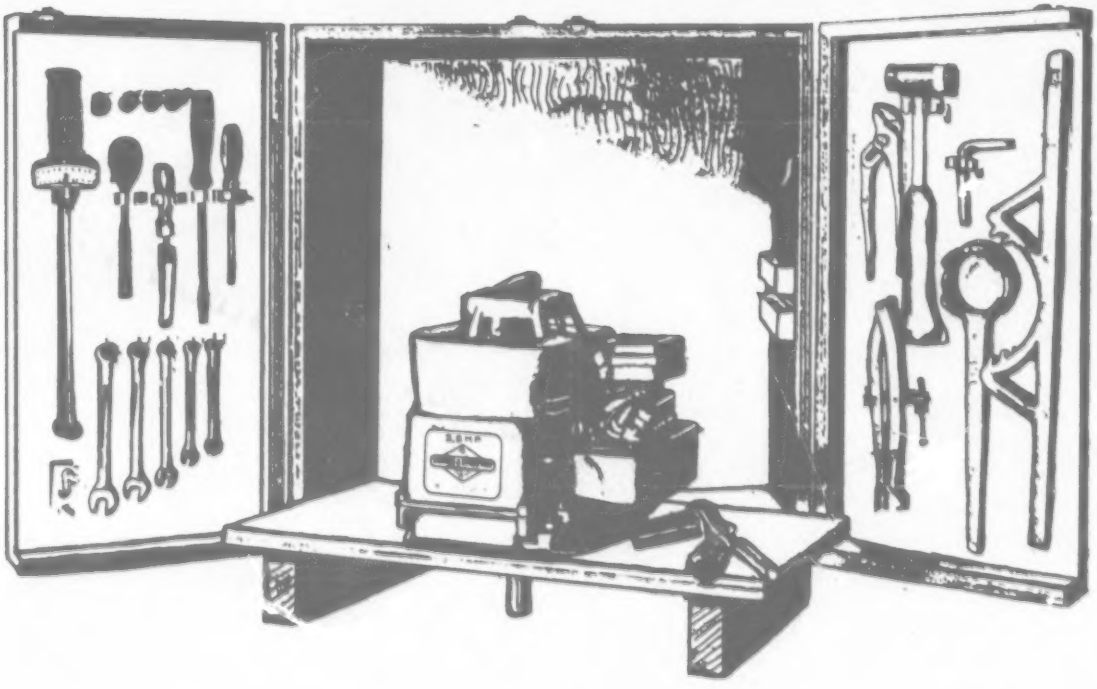


11. Open choke valve using throttle control. It should open and close completely. If it does not open, recheck your adjustment.



12. Reconnect spark-plug wire.

13. Clean your work area and return tools to their proper places.



SEE YOUR INSTRUCTOR

Unit 13
Adjusting the Carburetor Choke

Practical Exercise Performance Checklist

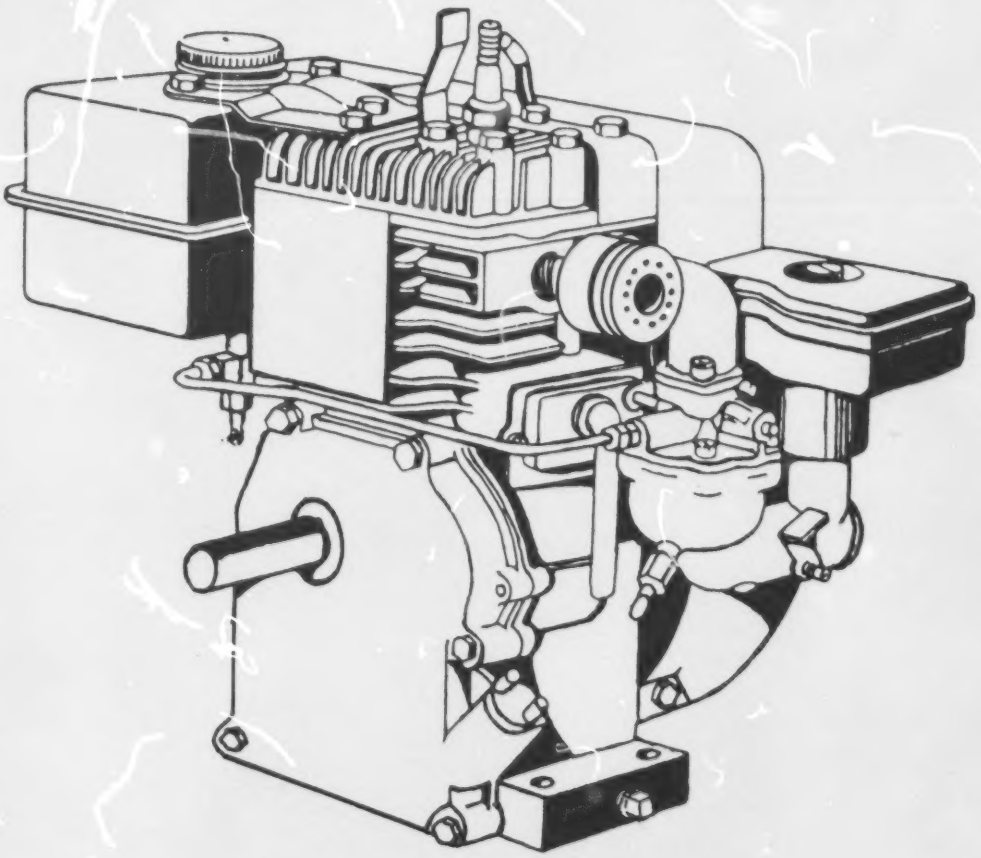
The student_____successfully performed the following tasks:

Tasks	Yes	No	Comments
1. Identified:			
a. Standard screwdriver			
b. Phillips screwdriver			
c. Open-end wrench			
d. Long-nose pliers			
e. Operator's manual			
f. Shop towels			
g. Safety equipment			
2. Wore proper safety equipment			
3. Read operator's manual			
4. Removed spark-plug wire			
5. Removed carburetor air cleaner			
6. Closed choke valve using throttle control			
7. Observed position of the choke valve			
8. Loosened the set screw holding the control linkage			
9. Closed the choke valve			
10. Tightened the set screw			
11. Opened choke valve using the controls			
12. Reconnected spark-plug wire			
13. Cleaned work area and returned tools to their proper places			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 14

Adjusting the High-Speed Load Valve

PRACTICAL ARTS AND VOCATIONAL-TECHNICAL EDUCATION
IML
INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 14
Adjusting the High-Speed Load Valve

Adjusting the High-Speed Load Valve

After you study this lesson, you should be able to:

1. Identify tools and materials used in adjusting the high-speed load valve.
2. Adjust the high-speed load valve.

Show What You Can Do.

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

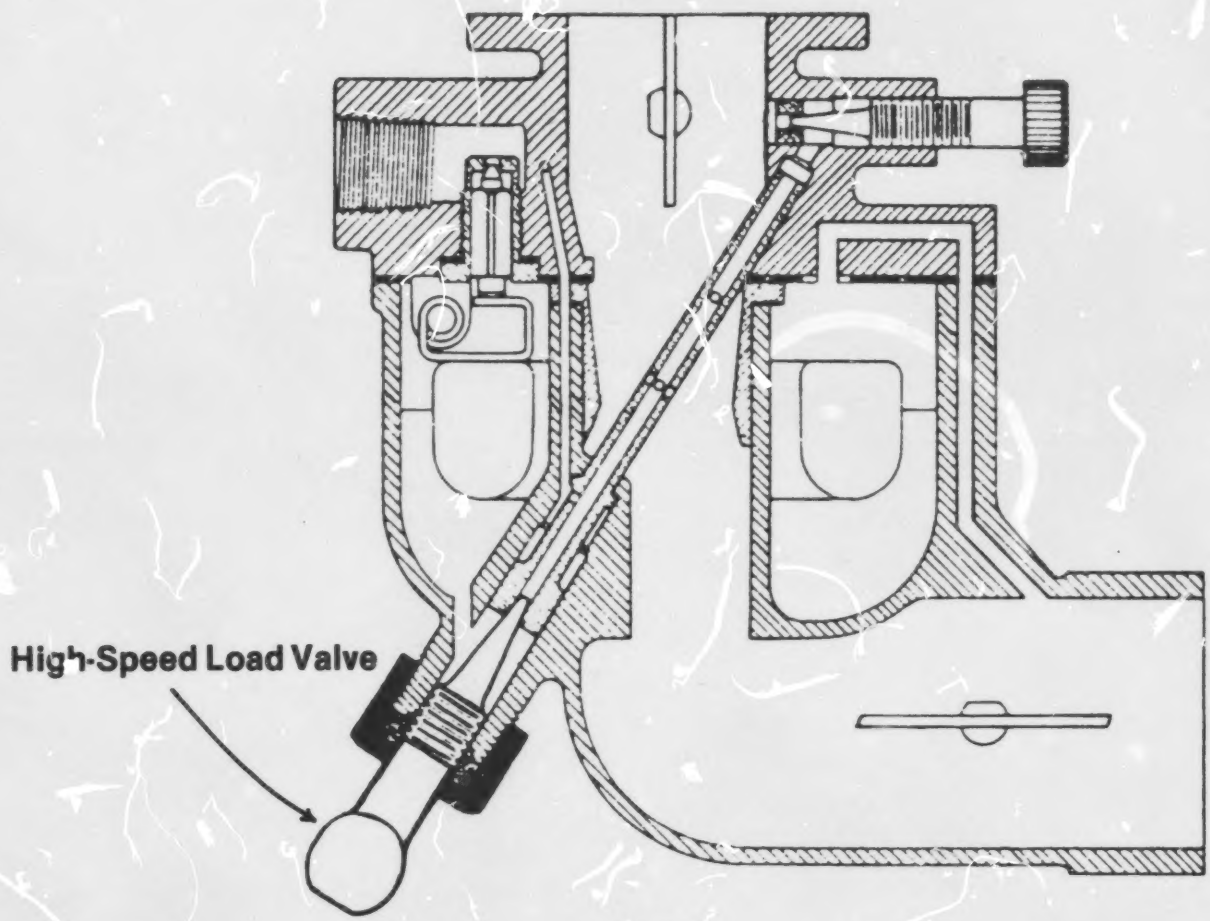
☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

TURN THE PAGE AND BEGIN

Unit 14
Adjusting the High-Speed Load Valve

Introduction

Performance of a small engine depends on proper adjustment of the high-speed valve. This valve controls the fuel flow for full load at high speed.



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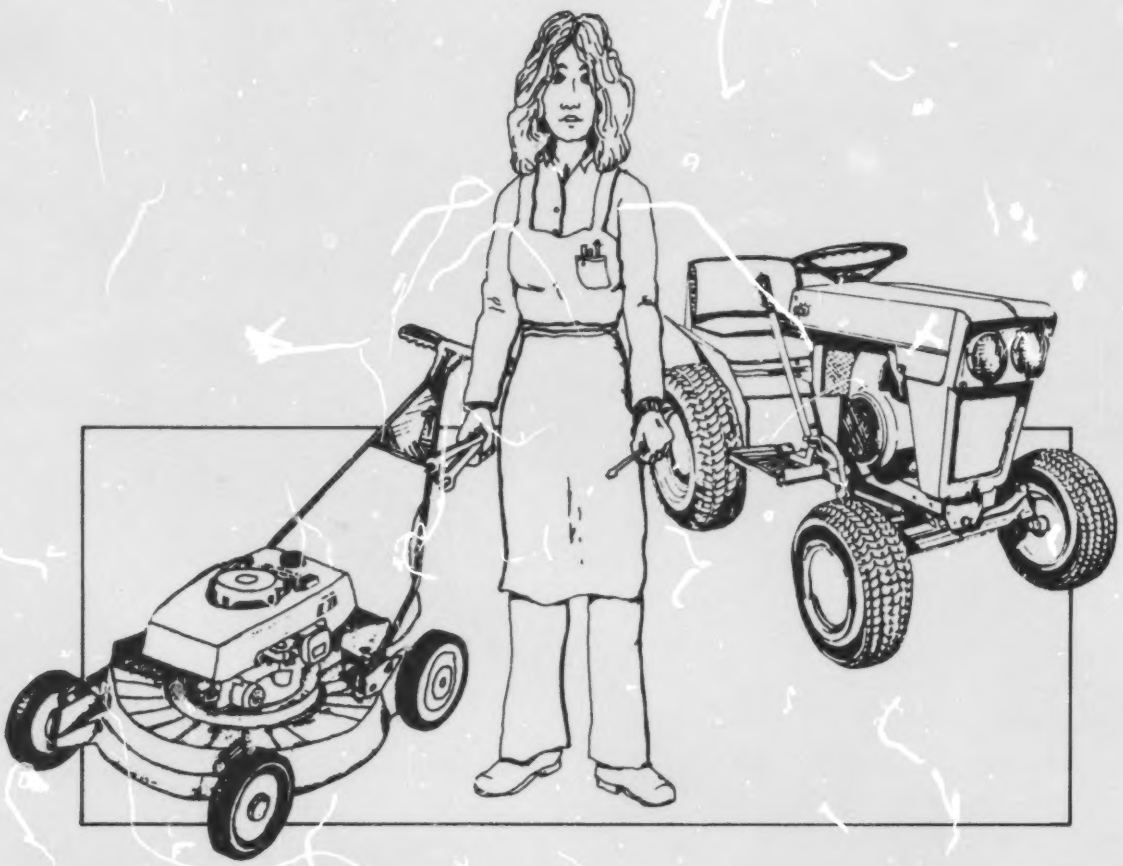
TURN TO NEXT PAGE

Unit 14
Adjusting the High-Speed Load Valve

A. Tools, Materials and Equipment needed in Adjusting the High-Speed Load Valve.

You have already used all the tools and equipment necessary to complete this unit.



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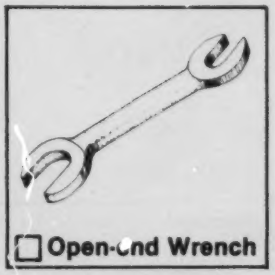
B. Steps in Adjusting the High-Speed Load Valve.

1. Find and Check Off the following:

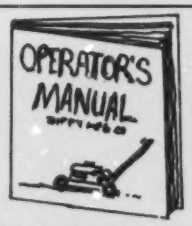
☐ Standard Screwdriver

☐ Phillips Screwdriver



☐ Open-end Wrench

☐ Long-nose Pliers



☐ Operator's Manual

☐ Shop Towels

☐ Safety Equip.

2. Wear proper safety equipment.

3. Read operator's manual.

NOTE!

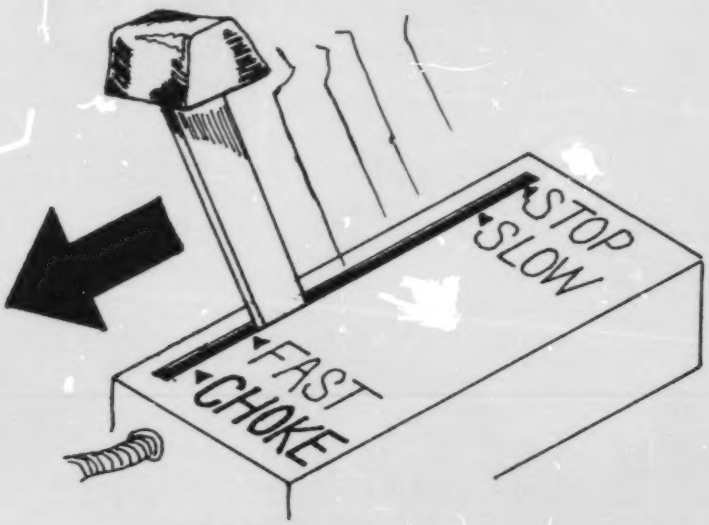
Check with your instructor before starting engine.

4. Start engine and run to full operating temperature.

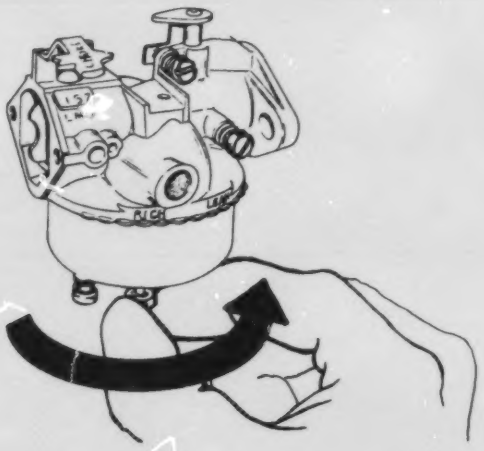
NOTE!

It is very important that the engine be at operating temperature when adjustments are made.

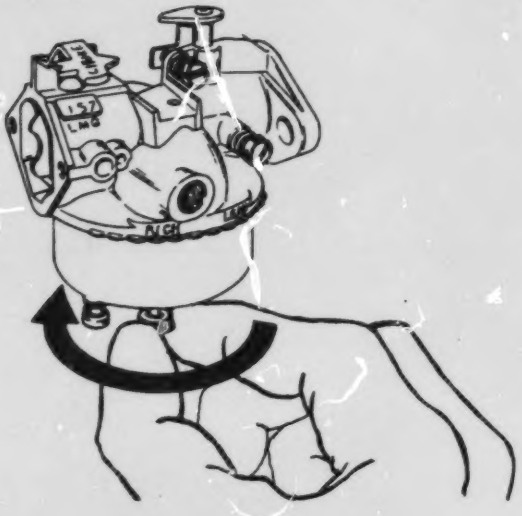
5. Advance throttle control until speed decreases slightly from high idle speed.



6. Turn high-speed load adjusting screw clockwise until engine begins to loose power.



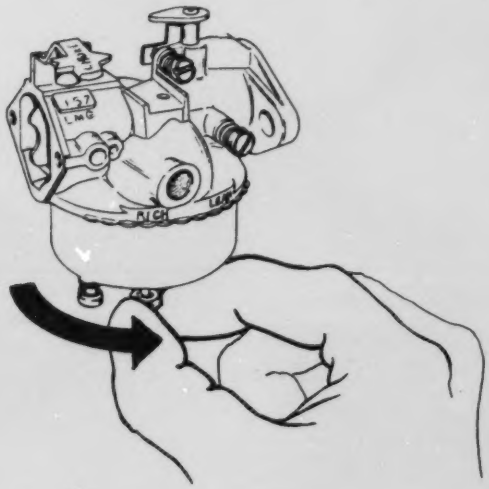
7. Turn adjusting screw counterclockwise until engine gives off black smoke from exhaust.



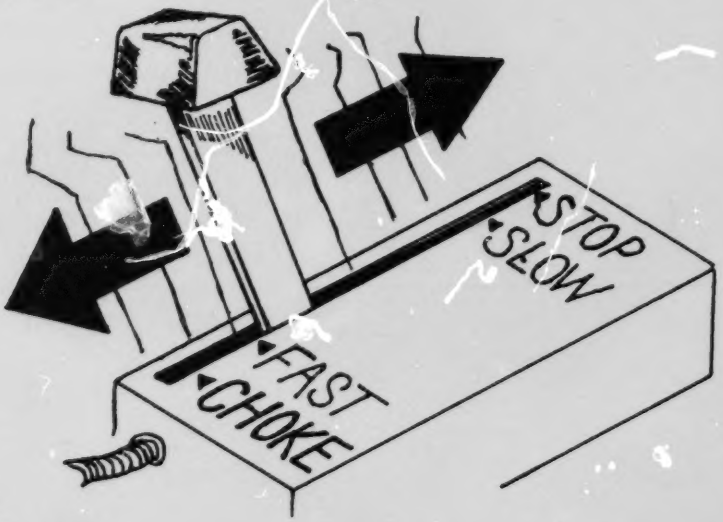
NOTE!

Now the fuel-air mixture is too rich.

8. Turn screw clockwise 1/8 turn until engine runs smoothly and at full speed.



9. Check carburetor adjustment by speeding the engine quickly while it is under load.



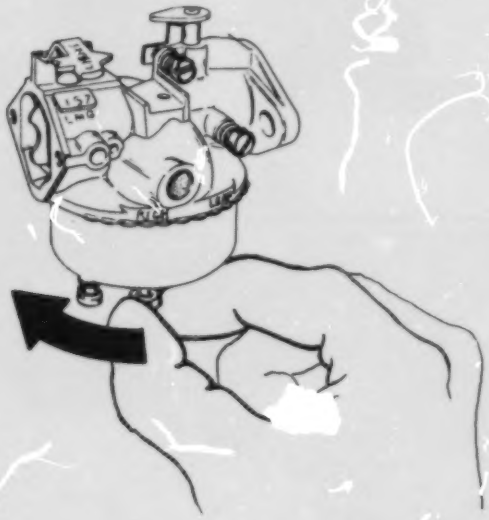
NOTE!

If the engine accelerates quickly the carburetor is adjusted properly.

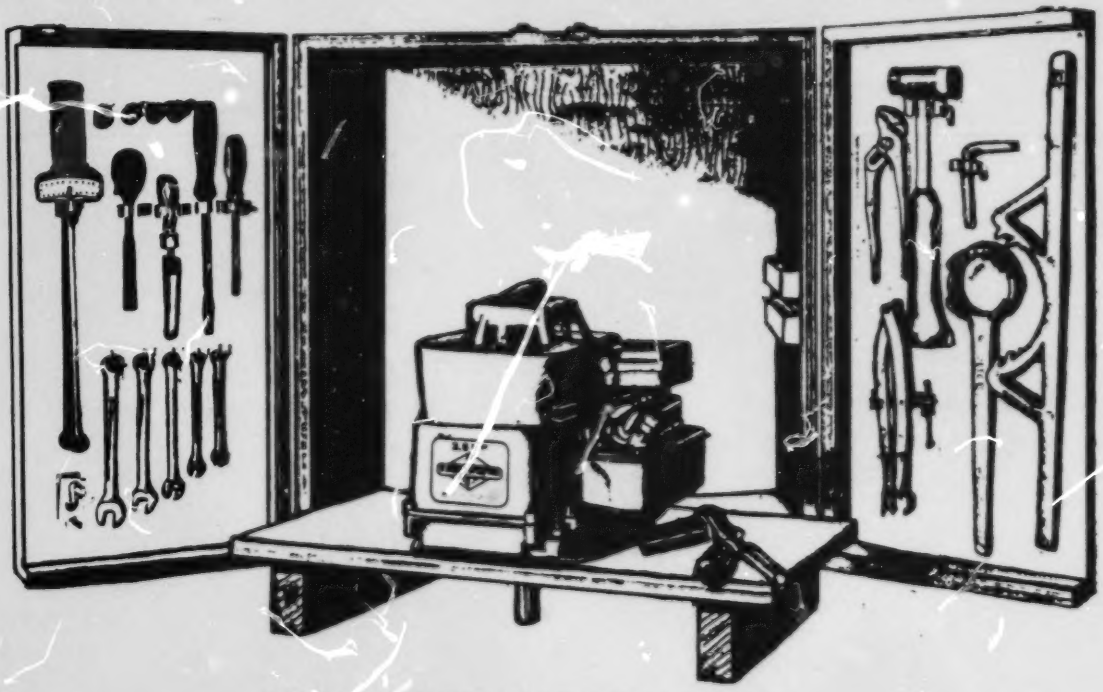
Backfiring indicates too lean a mixture.

Black smoke indicates too rich a mixture.

10. Adjust fuel-air mixture slightly on the rich side - about 1/16 of a turn. The carburetor adjustment is complete and ready for heavy loads.



11. Clean your work area and return tools to their proper places.



SEE YOUR INSTRUCTOR

Unit 14
Adjusting the High-Speed Load Valve

Practical Exercise Performance Checklist

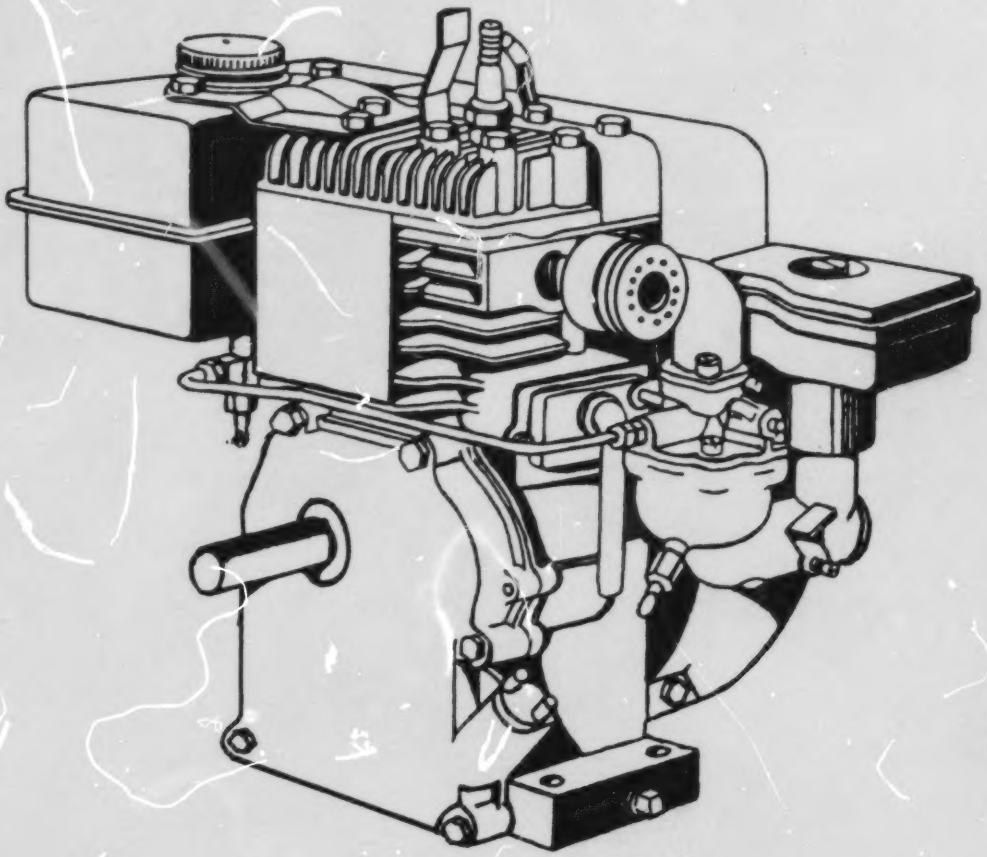
The student _____ successfully performed the following tasks:

Tasks	Yes	No	Comments
1. Identified:			
a. Standard screwdriver			
b. Phillips screwdriver			
c. Open-end wrench			
d. Long-nose pliers			
e. Operator's manual			
f. Shop towels			
g. Safety equip.			
2. Wore proper safety equipment			
3. Read operator's manual			
4. Started engine and ran to full operating temperature			
5. Advanced throttle control until speed decreased slightly from high idle speed			
6. Turned high-speed load adjusting screw clockwise until engine began to loose power			
7. Turned adjusting screw counterclockwise until engine gave off black smoke from exhaust			
8. Turned adjusting screw clockwise until engine ran smoothly			
9. Checked carburetor adjustment by [illegible]ing the engine quickly under load			
10. Adjusted fuel-air mixture slightly on the rich side			
11. Cleaned work area and returned tools to their proper places			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 15

Checking the Ignition System

PRACTICAL ARTS
AND
VOCATIONAL-TECHNICAL
EDUCATION

IMI

INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 15
Checking the Ignition System

Checking the Ignition System

After you study this lesson, you should be able to:

1. Identify tools and materials used in checking the ignition system.
2. Remove starter clutch and flywheel.
3. Remove dust cover and contact points.
4. Install new points and condenser.
5. Properly set breaker point gap.
6. Replace flywheel and starter clutch.
7. Check engine to see if it runs properly.

Show What You Can Do.

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

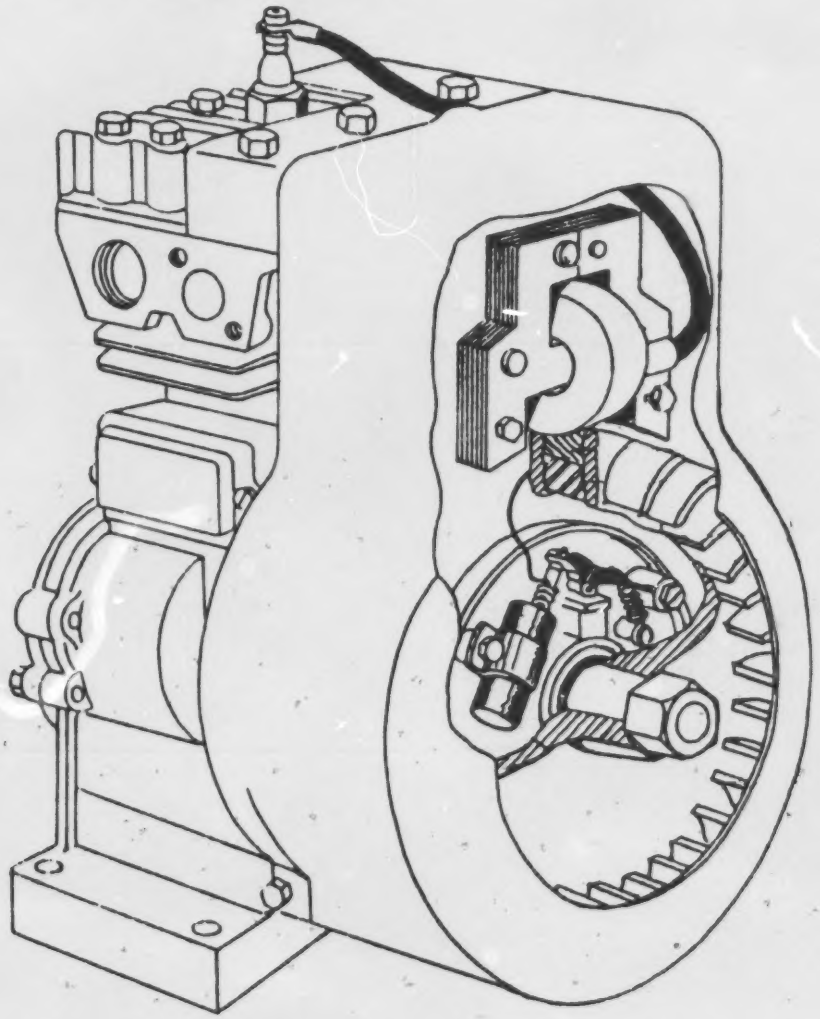
☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

TURN THE PAGE AND BEGIN

Unit 15
Checking the Ignition System

Introduction

The ignition system on your engine must be electrically sound and in good mechanical condition for the engine to run properly. In this unit you will learn how to remove and replace the breaker points and condenser, how to check out the ignition system, and see that your engine is running properly.



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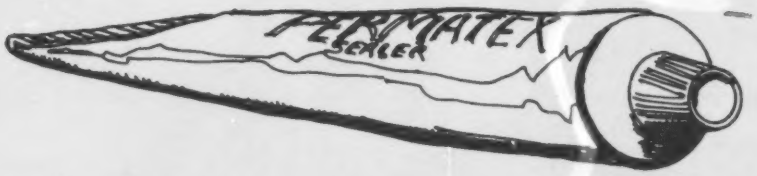
Unit 15
Checking the Ignition System

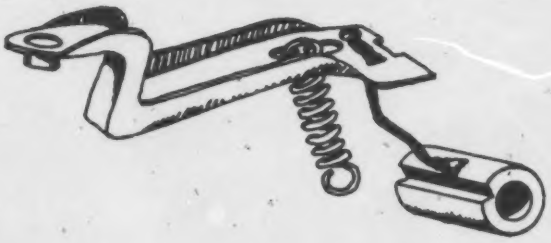
A. Tools, Materials and Equipment needed in Checking the Ignition System.

1. **CARD STOCK OR POSTAL CARD:** Used to check the air gap.

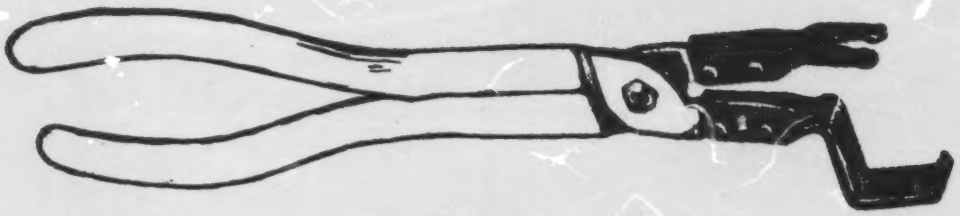
2. **PERMATEX SEALER:** Used to seal breaker point cover.



3. **IGNITION BREAKER POINTS AND CONDENSER:** Used to make and break the primary circuit, allowing the coil to produce high voltage at the spark plug.



4. **CONDENSER SPRING COMPRESSOR:** Used to compress spring on condenser for removal of wires.



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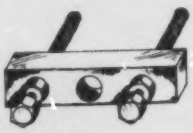
B. Steps in Checking the Ignition System - Disassembly.

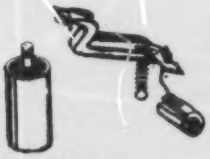
1. Find and Check Off the following:

☐ Flywheel Holder

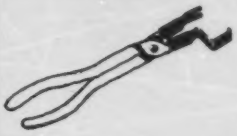
Starter
☐ Clutch Wrench



☐ Flywheel Puller

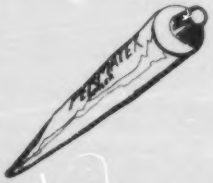


Condenser
☐ Breaker Points

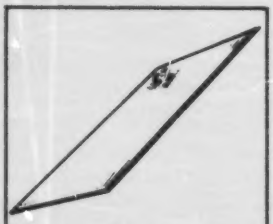


Condenser Spring
☐ Compressor

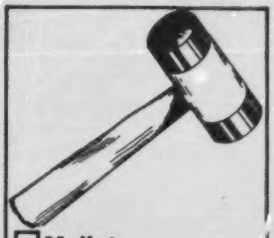
☐ Feeler Gauge



☐ Sealer



☐ Card Stock



☐ Mallet

☐ Penetrating Oil

☐ Safety Equip.

☐ Shop Towels

☐ Operator's Manual

☐ Long-nose Pliers

☐ Phillips Screwdriver

☐ Standard Screwdriver

☐ Open-end Wrenches

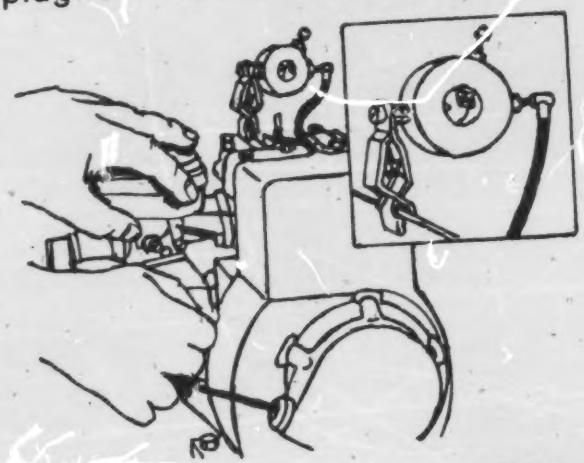
☐ Spark Tester

☐ Socket Wrench Set

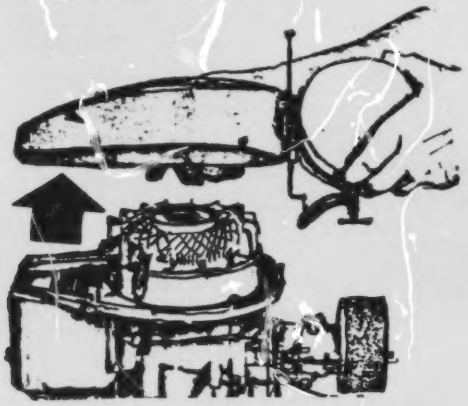
2. Wear proper safety equipment.

3. Read operator's manual.

4. Check spark plug for fire, then remove the plug.

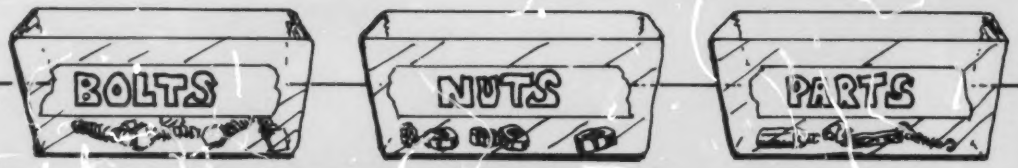


5. Remove flywheel shroud. Remove throttle cable if necessary.

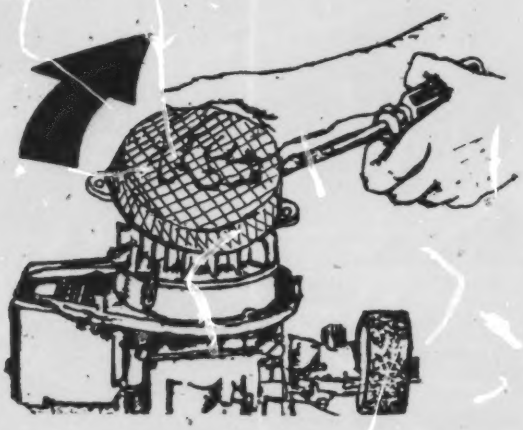


NOTE!

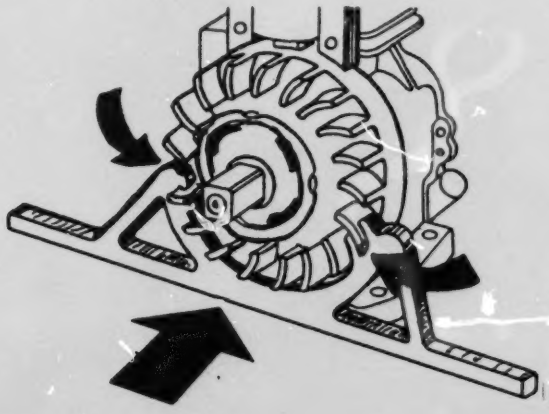
When disassembling engine, place bolts, nuts and parts in containers for safe keeping.



6. Remove flywheel screen from flywheel.

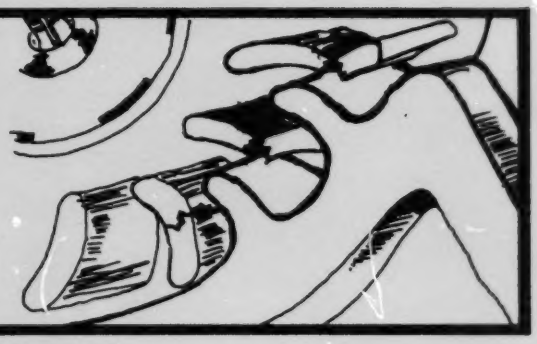


7. Place flywheel holder securely on flywheel.

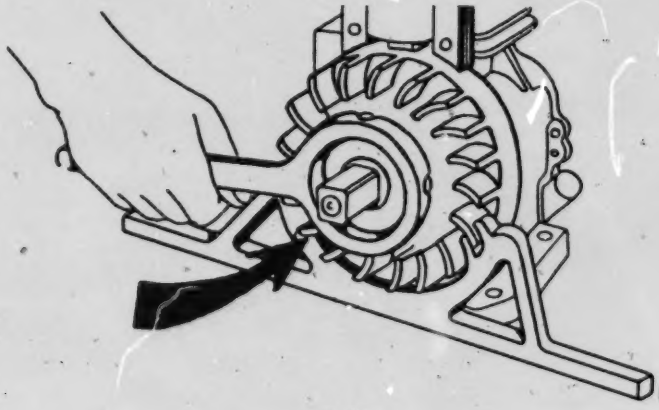


CAUTION!

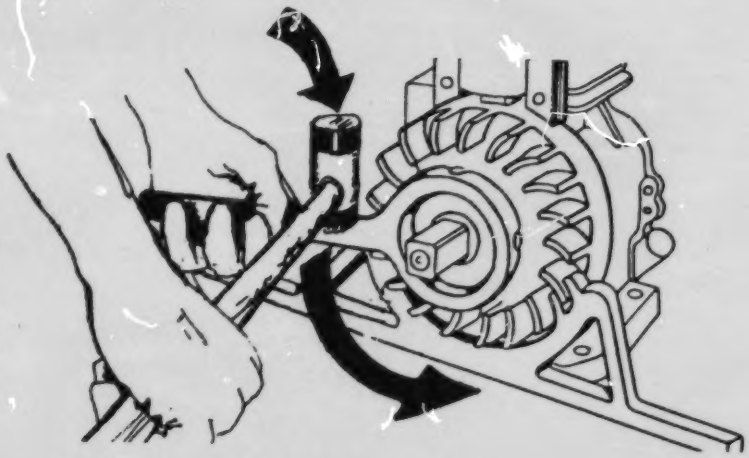
Place holder firmly onto flywheel to avoid damaging flywheel fins.



8. Place starter clutch wrench securely on starter clutch.



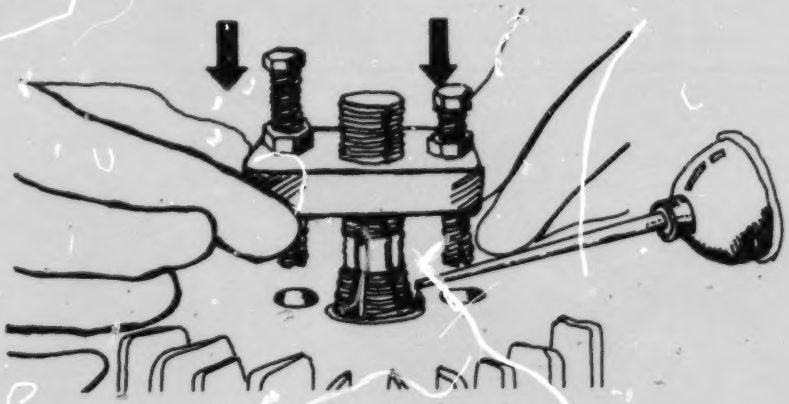
9. Tap wrench handle with mallet to loosen and remove starter clutch



NOTE!

Use penetrating oil around flywheel to help loosen.

10. Place flywheel puller on flywheel.

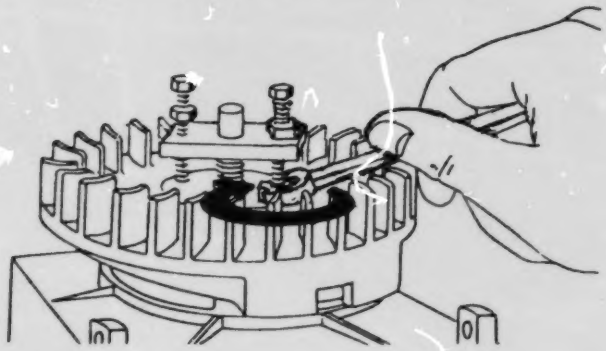


11. Fasten flywheel puller to flywheel with the two self-tapping screws.

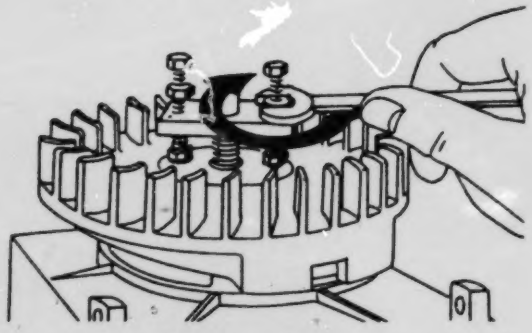
NOTE!

Make sure you thread self-tapping screws into flywheel as far as they can go.

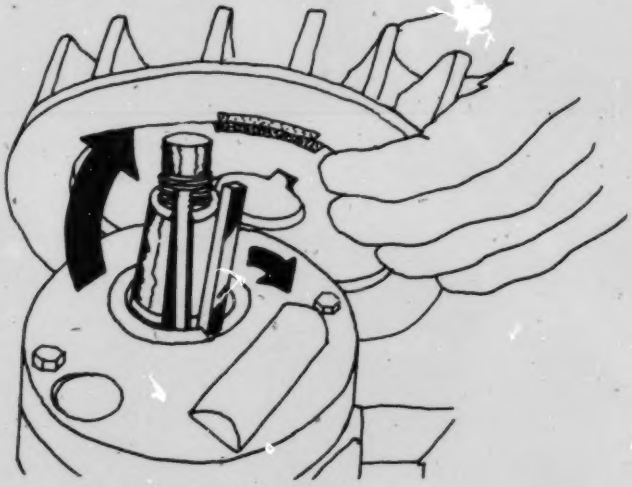
12. Turn the two bottom nuts tightly against flywheel.



13. Turn the two top nuts to loosen flywheel.



14. Remove and inspect flywheel and key.

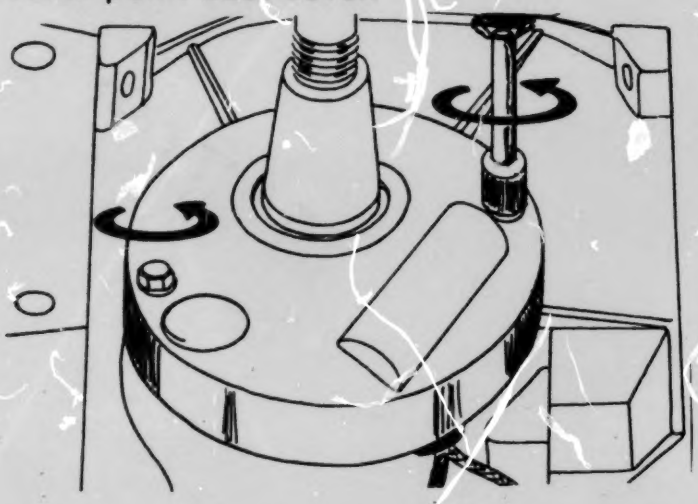


NOTE!

Check condition of flywheel keyway and magnet.
Check key closely for damage.
If damaged, replace with new aluminum key.

15. Wrap flywheel in a shop towel to prevent magnet from picking up bolts and nuts.

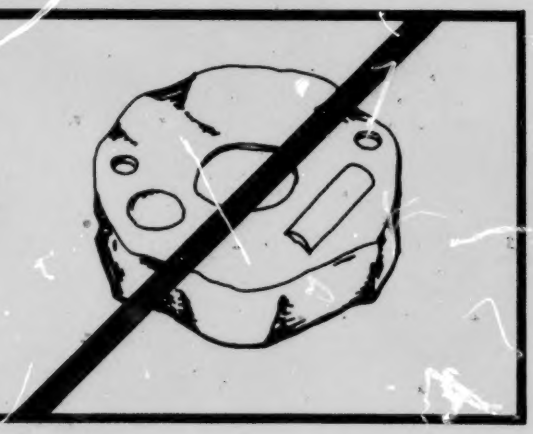
16. Remove breaker point dust cover.



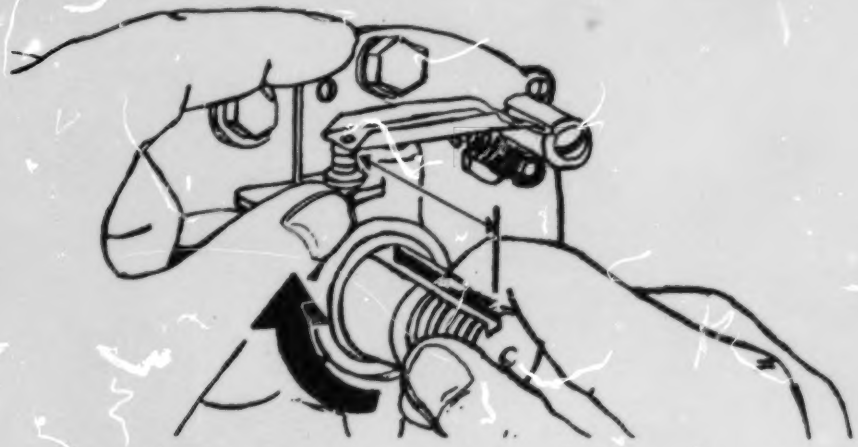
CAUTION!

When removing cover,

do not bend it.



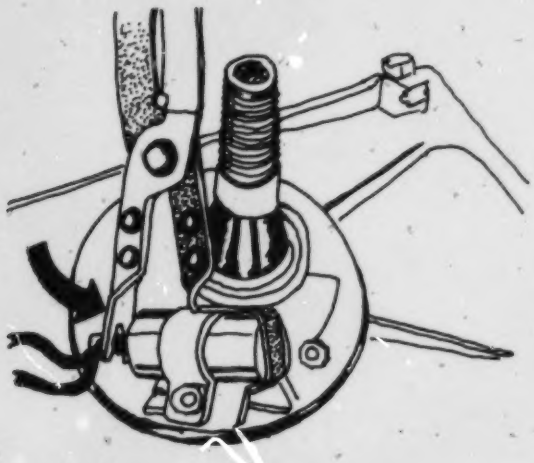
17. Turn crankshaft clockwise with your hand until keyway is in line with the breaker plunger.



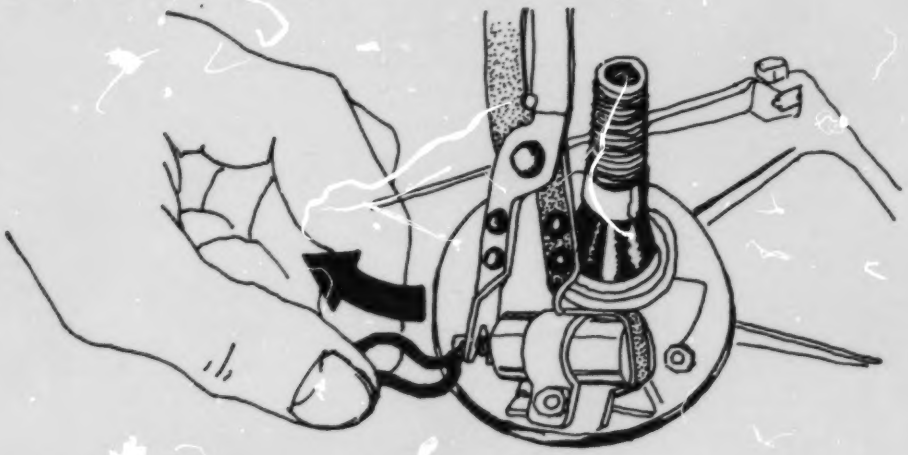
NOTE!

At this point cam is at its highest position.

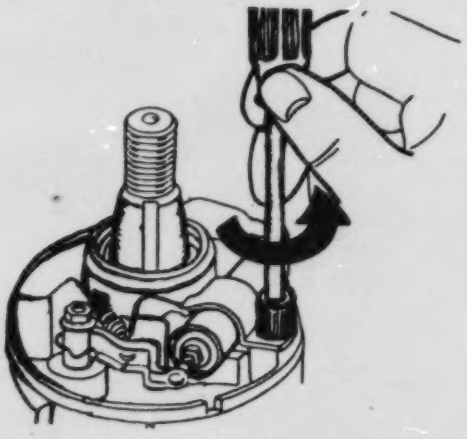
18. Push back spring on condenser with condenser spring compressor.



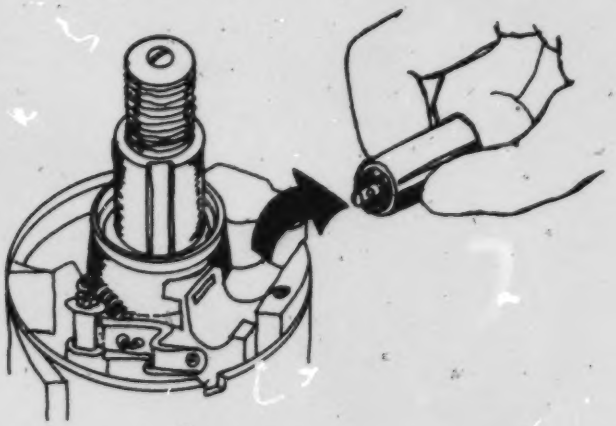
19. While holding back the spring, pull the two wires out of the hole on the condenser.



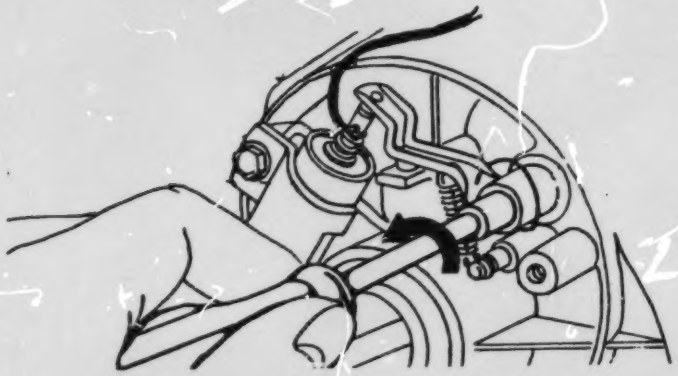
20. Remove bolt and clamp over the condenser.



21. Remove and discard the fixed contact point and condenser.



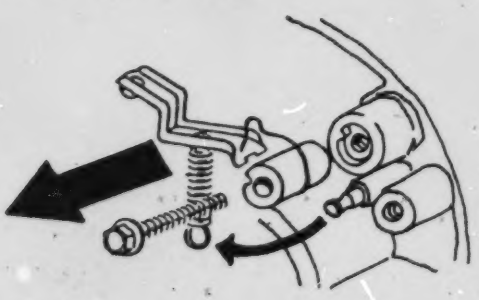
22. Loosen mounting bolt and remove the movable contact point.



NOTE!

When mounting bolt is loosened, the contact point loses its tension.

23. Lift spring from post and remove mounting bolt, contact point, mounting post, and spring.



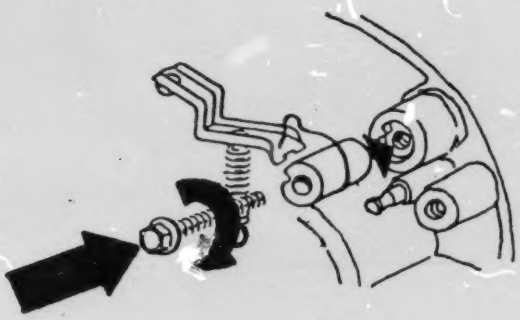
NOTE!

Keep the mounting bolt.
Always replace old contact points with a new set.

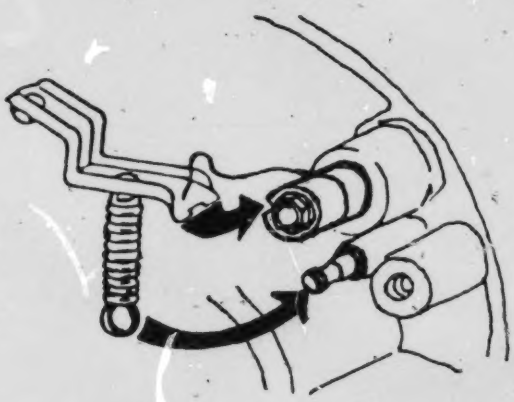
C. Steps in Checking the Ignition System - Reassembly.

24. Install new movable contact point. Hook open loop of spring through large hole then through small hole, then through small hole on the contact point arm.

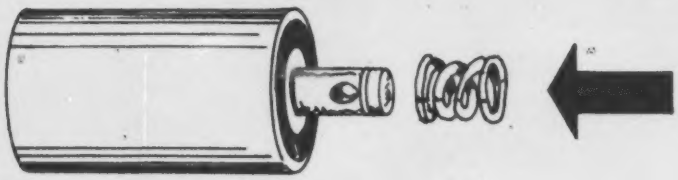
25. Place mounting bolt into post and tighten.



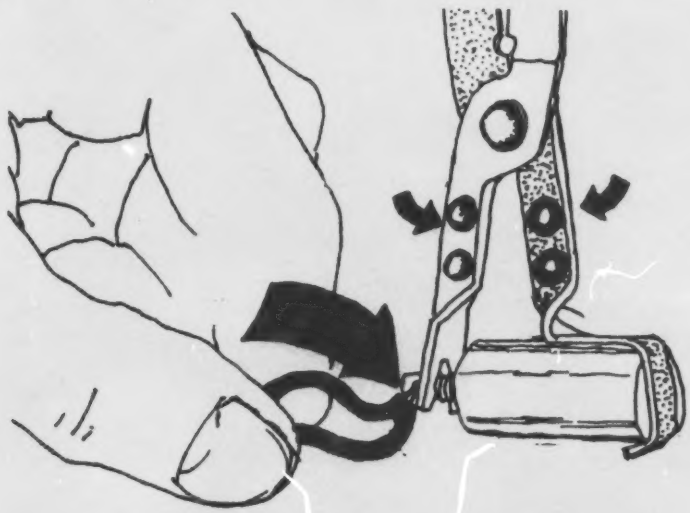
26. Fit end of contact point arm into groove in mounting post. Hook closed loop of spring onto the small post.



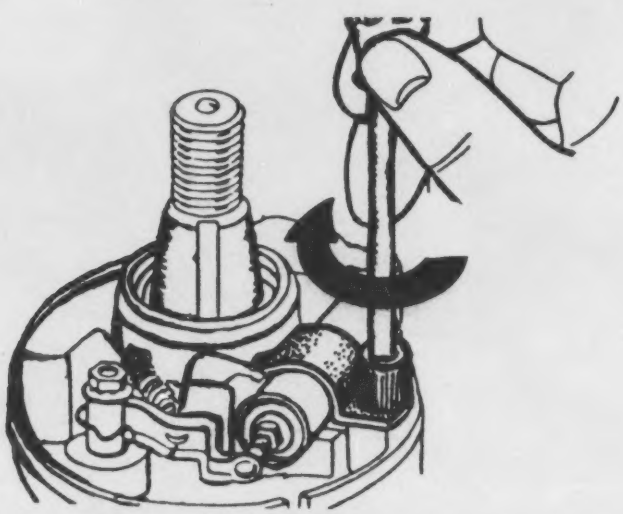
27. Place spring on condenser and hold it in place.



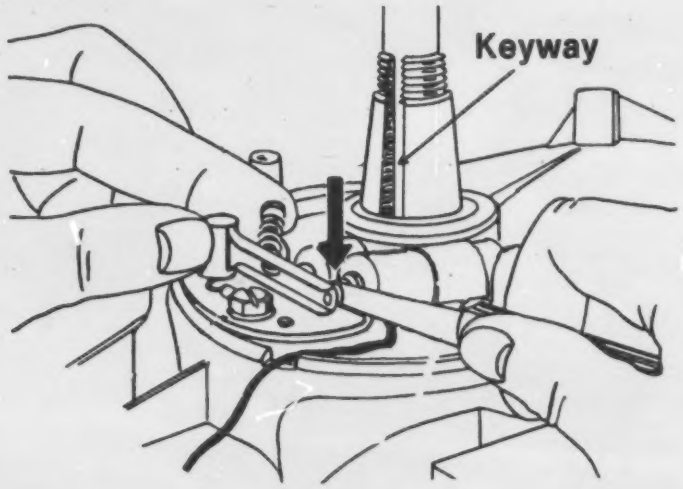
28. Compress spring and slip the two wires into the hole on condenser.



29. Install new condenser and clamp in place. Tighten the clamp bolt.



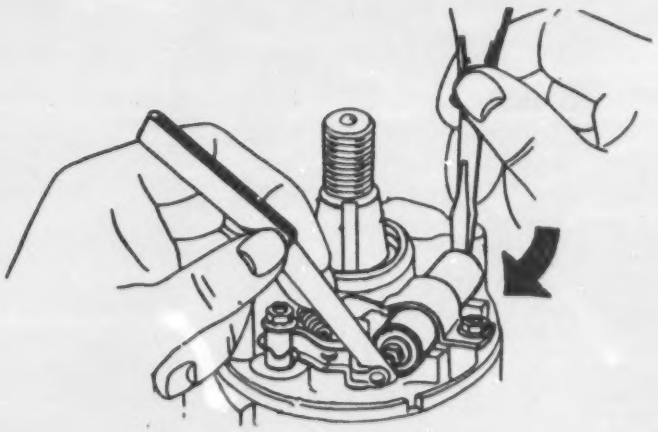
30. Select correct sized feeler gauge. Place it in gap between the two contact points.



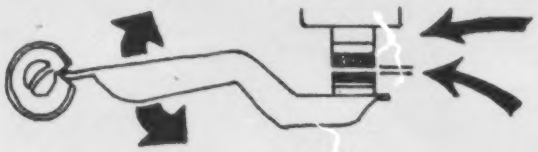
NOTE!

Make sure the crankshaft keyway is lined up with the breaker plunger.

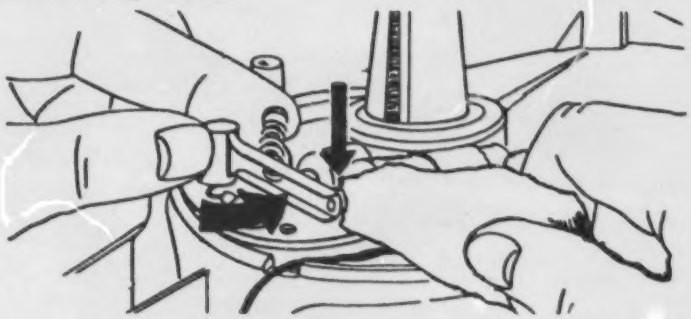
31. While holding feeler gauge in the gap, push condenser forward with a screwdriver until there is no gap between the two points and feeler gauge.



32. Make sure the two contact points fit squarely together, and not at an angle.
Adjust the movable contact point if necessary.



33. Open the points. Place a piece of paper between the points. Close the points with paper still between them. This removes any grease on the points.

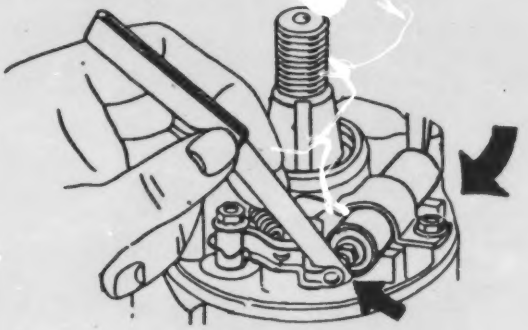


34. Open points and remove the paper.

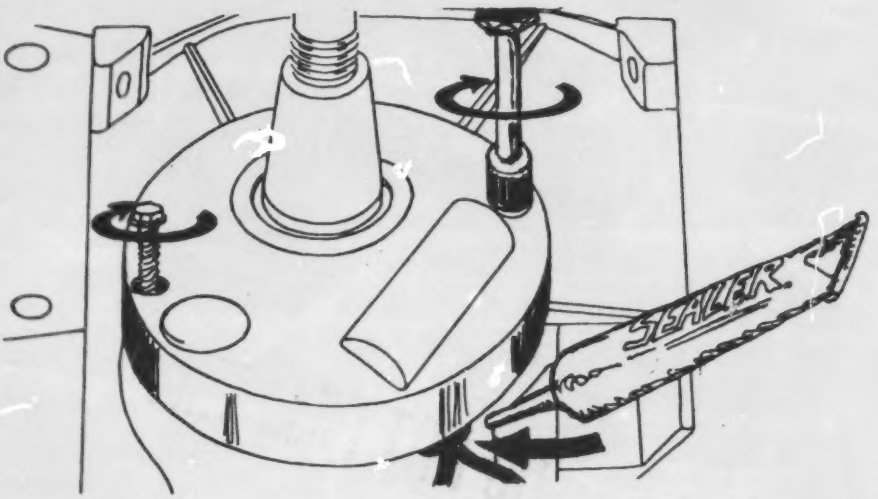
CAUTION!

Always open points when removing paper.

35. Recheck condenser clamp bolt and gap setting.



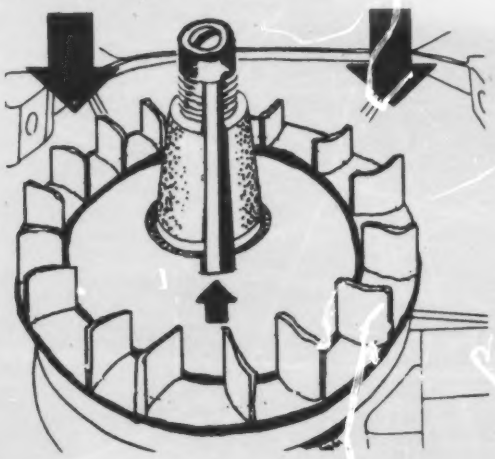
36. Place sealer around wiring. Replace dust cover and bolts on the points and condenser.



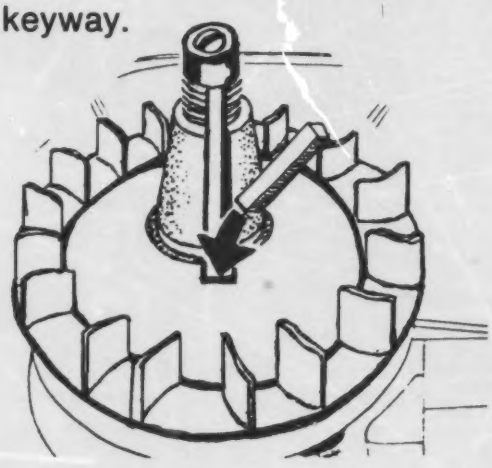
NOTE!

Do not overtighten the bolts because they will strip easily.

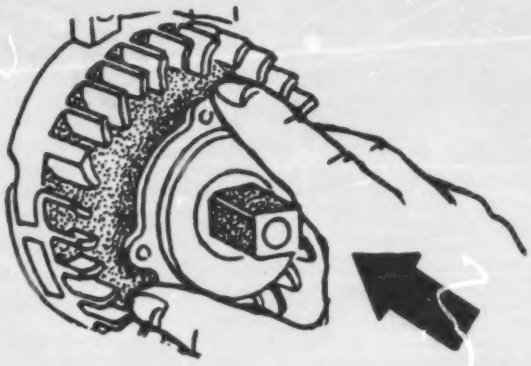
37. Place flywheel on crankshaft and line up the keyway.



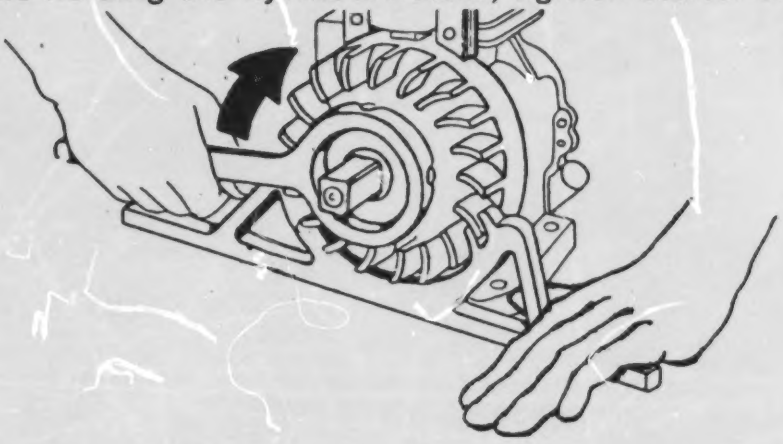
38. Place flywheel key in keyway.



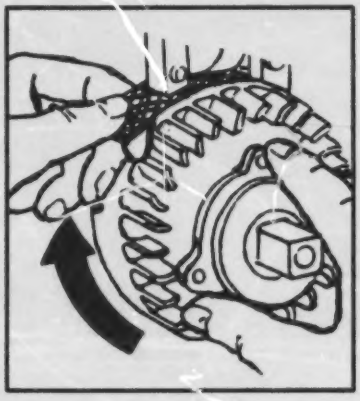
39. Place starter clutch onto crankshaft.

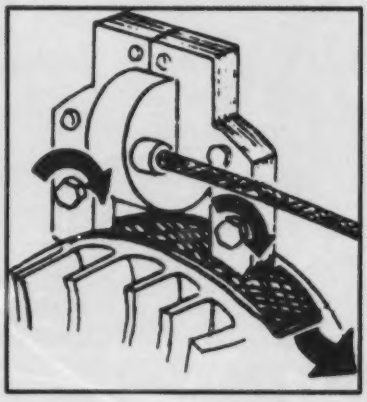


40. Place flywheel holder on flywheel and starter clutch wrench on starter clutch.
While holding the flywheel holder, tighten starter clutch.

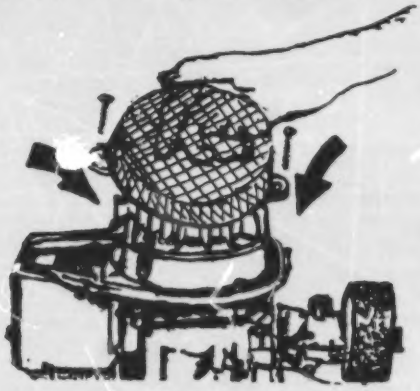


42. Check air gap by loosening the two armature bolts, inserting card stock between flywheel and armature, and rotating the flywheel until magnets pull armature down to card stock.
Tighten armature bolts and remove card stock.

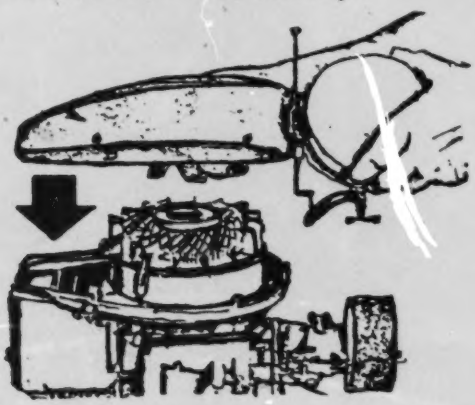




41. Attach flywheel screen over starter clutch.



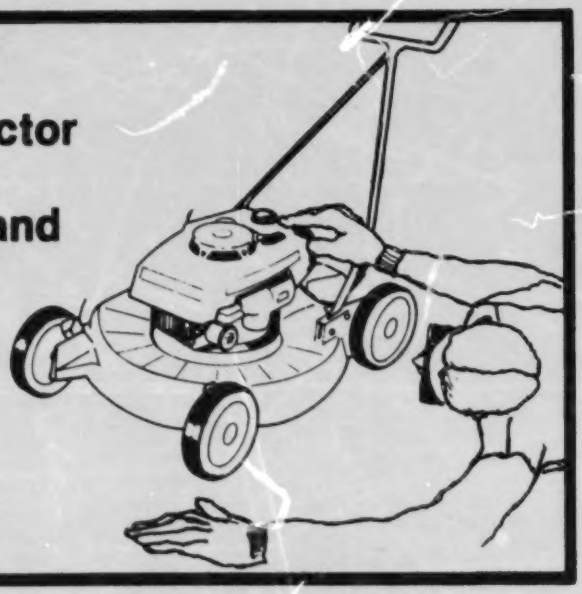
43. Replace flywheel shroud and tighten the bolts. Reconnect throttle cable if necessary.



44. Install the spark plug, reconnect the wire and check the spark.

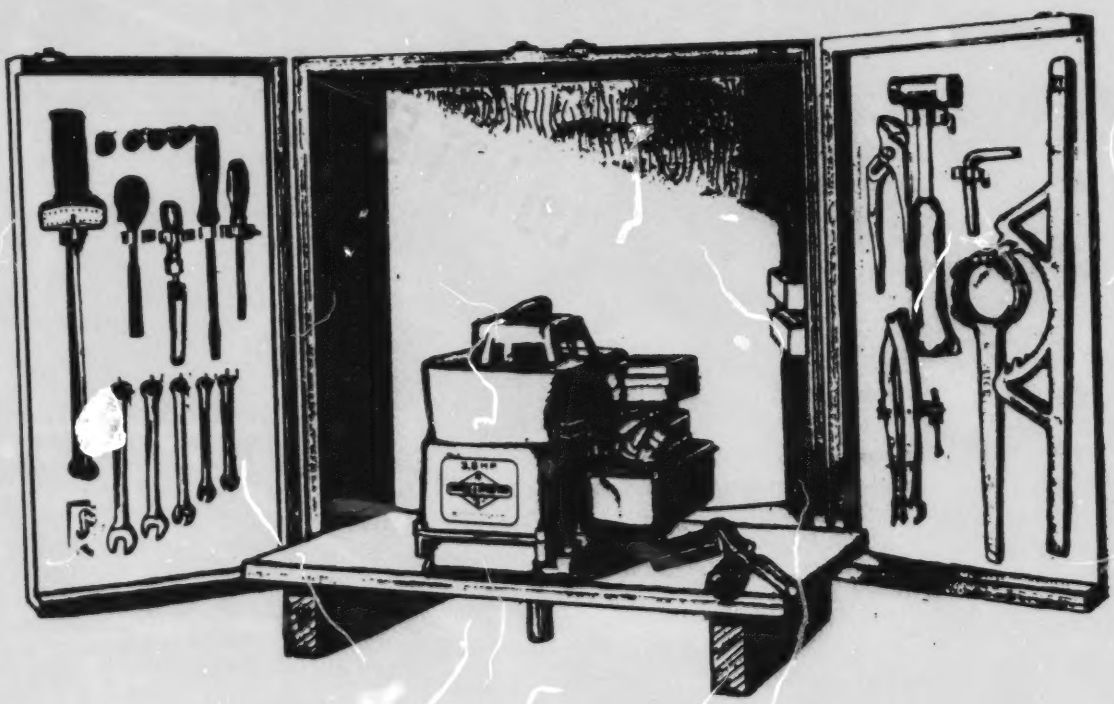
CAUTION!

Check with your instructor before starting engine. Make sure area under and around engine is clear before starting it.



45. Crank the engine to see if it runs properly.

46. Clean your work area and return tools to their proper places.



SEE YOUR INSTRUCTOR

Unit 15
Checking the Ignition System

Practical Exercise Performance Checklist

The student_____successfully performed the following tasks:

Tasks	Yes	No	Comments
1. Identified:			
a. Socket set			
b. Flywheel puller			
c. Open-end wrenches			
d. Standard screwdriver			
e. Phillips screwdriver			
f. Long-nose pliers			
g. Card stock			
h. Feeler gauge			
i. Permatex sealer			
j. Flywheel holder			
k. Starter clutch wrench			
l. Spark tester			
m.Condenser spring compressor			
n. Breaker points			
o. Condenser			
p. Mallet			
q. Operator's manual			
r. Shop towel			
s. Safety Equip.			
t. Penetrating oil			
Ignition System - Disassembly			
2. Wore proper safety equipment			
3. Read operator's manual			
4. Checked spark plug for fire			
5. Removed flywheel shroud			
6. Removed flywheel screen from flywheel			
7. Placed flywheel holder securely on flywheel			
8. Placed starter clutch wrench securely on starter clutch			
9. Loosened and removed starter clutch			
10. Placed flywheel puller on crankshaft			
11. Fastened flywheel puller to flywheel			
12. Turned two bottom nuts tightly against flywheel			

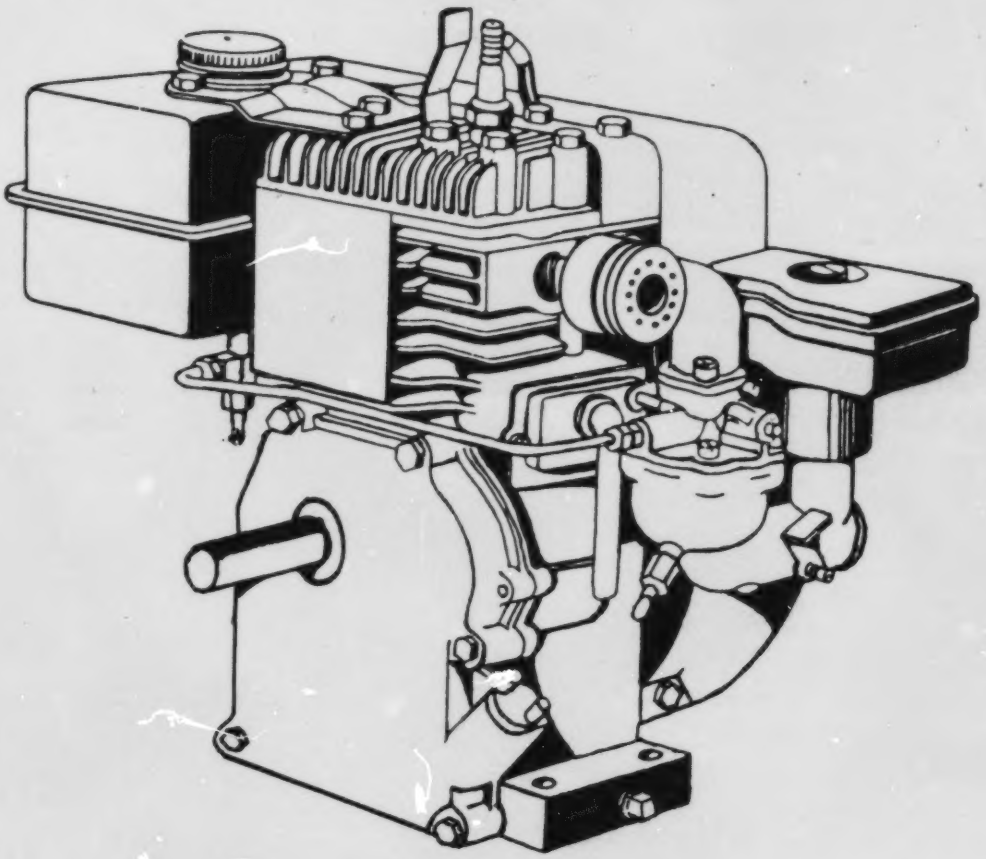
Tasks	Yes	No	Comments
13. Turned two top nuts to loosen flywheel			
14. Removed and inspected flywheel and key			
15. Wrapped flywheel in shop towel for protection			
16. Removed breaker point dust cover			
17. Turned crankshaft to align keyway with breaker plunger			
18. Removed contact point, condenser, and spring			
19. Pulled the two wires out of the condenser hole			
20. Removed bolt and clamp from condenser			
21. Removed fixed contact point and condenser			
22. Loosened mounting bolt and removed movable contact point			
23. Lifted spring and removed mounting bolt, contact point, mounting post, and spring.			
Ignition System - Reassembly			
24. Installed new movable contact point and spring			
25. Tightened mounting bolt into post			
26. Fit contact point arm onto mounting post and hooked spring to small post			
27. Placed spring on condenser			
28. Compressed spring and slipped wires into condenser hole			
29. Installed new condenser and clamp			
30. Placed feeler gauge in gap between two contact points			
31. Correctly closed gap between the two points			
32. Made sure contact points fit squarely. Adjusted them if necessary			
33. Placed card stock between points to remove grease			
34. Removed card stock			
35. Rechecked condenser clamp bolt and gap setting			
36. Placed sealer around wiring and replaced dust cover			
37. Returned flywheel to crankshaft and aligned keyway			
38. Placed flywheel key in keyway			
39. Placed starter clutch onto crankshaft			

Tasks	Yes	No	Comments
40. Tightened starter clutch			
41. Covered starter clutch with flywheel screen			
42. Checked air gap between flywheel and armature			
43. Replaced flywheel shroud and reconnected throttle cable if necessary			
44. Installed and reconnected sparkplug, then checked the spark			
45. Cranked engine to check for proper running			
46. Cleaned work area and returned tools to proper places			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date

Vocational Preparation Curriculum
MAINTAINING SMALL ENGINES



Unit 16

Starting and Operating Small Engines

PRACTICAL ARTS AND VOCATIONAL-TECHNICAL EDUCATION
IML
INSTRUCTIONAL MATERIALS LABORATORY
UNIVERSITY OF MISSOURI-COLUMBIA

Unit 16
Starting and Operating Small Engines

Starting and Operating Small Engines

After you study this lesson, you should be able to:

1. Identify tools and materials used in starting and operating small engines.
2. Start and operate a small engine.
3. Check engine to see if it is running properly.

Show What You Can Do.

Check the statement that fits you best.

☐ **I can do all the tasks above and want my instructor to check me through the Practical Exercise Performance Checklist.**

SEE YOUR INSTRUCTOR

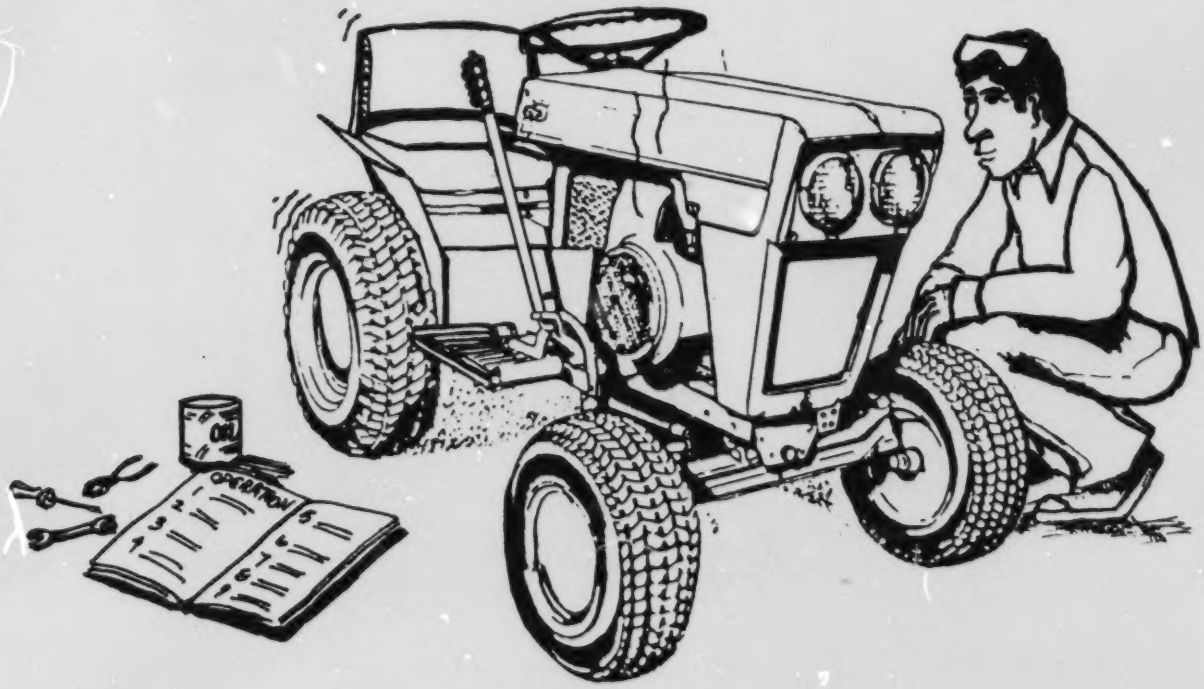
☐ **I want to study the information in this unit before I do the Practical Exercise Performance Checklist.**

TURN THE PAGE AND BEGIN

Unit 16
Starting and Operating Small Engines

Introduction

Certain procedures should be followed when starting and operating a small engine. This assures that the engine will operate at its best and will not cause unnecessary problems because of poor maintenance. Study the operator's manual and follow the correct procedures in starting and operating small engines.



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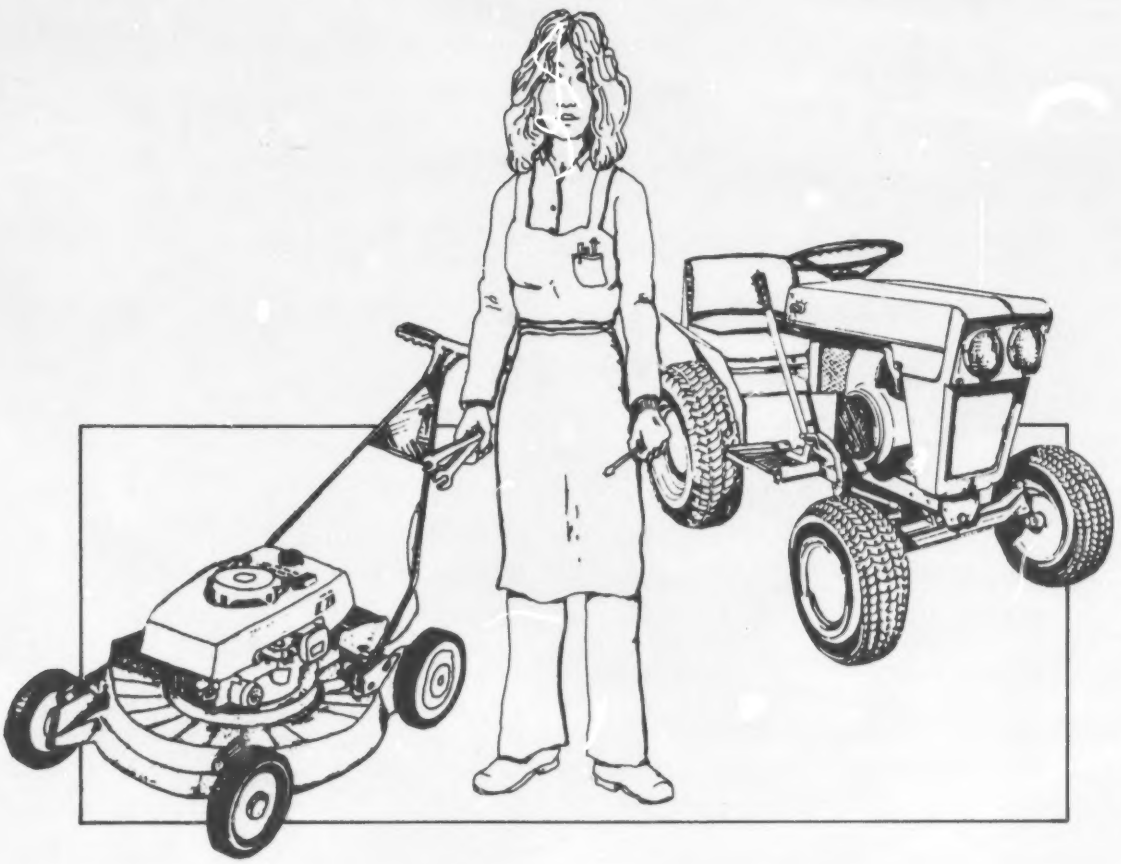
Unit 16
Starting and Operating Small Engines

A. Tools, Materials and Equipment needed in Starting and Operating Small Engines.

You have already used all the tools and equipment necessary to complete this unit.



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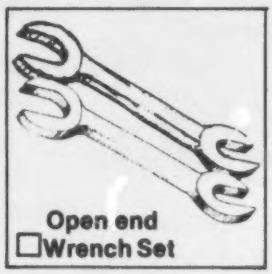
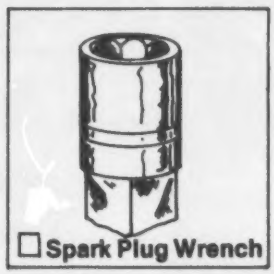
B. Steps in Starting and Operating Small Engines

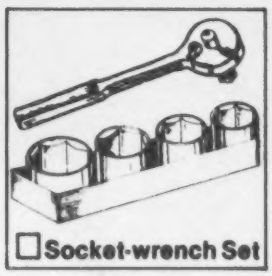
1. Find and Check Off the following:

☐ Standard Screwdriver

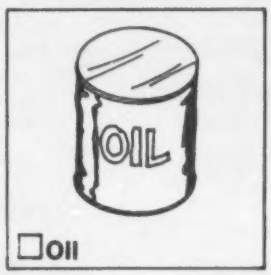

☐ Open end Wrench Set

☐ Phillips Screwdriver


☐ Spark Plug Wrench


☐ Socket-wrench Set

☐ Long-nose Pliers



☐ Oil

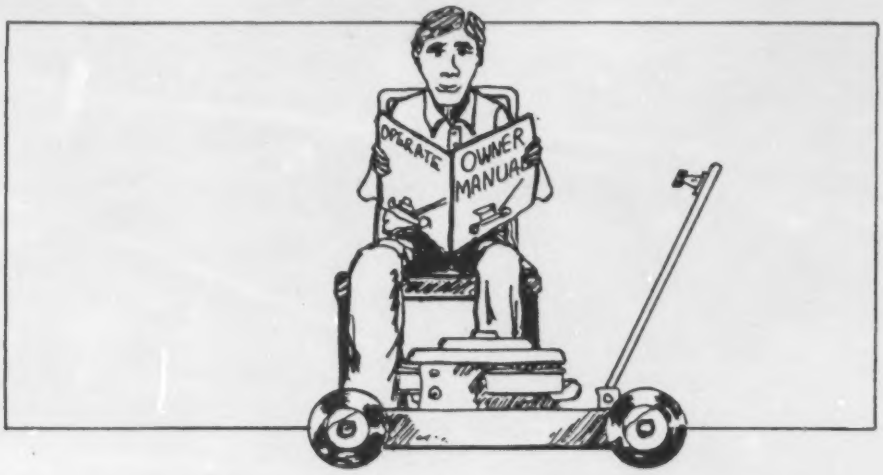
☐ Operator's Manual

☐ Shop Towels

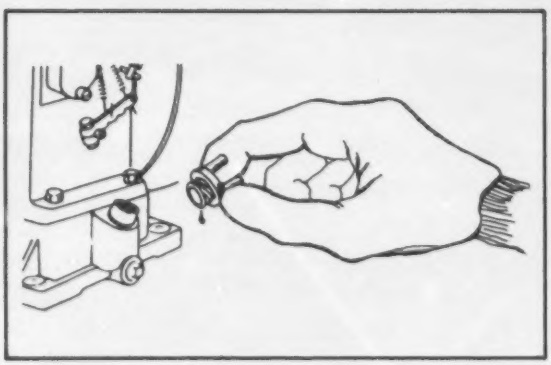
☐ Safety Equip.

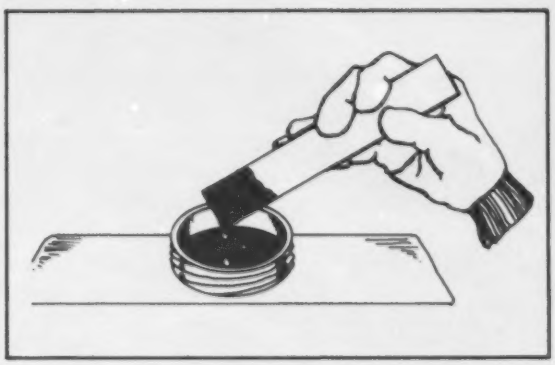
2. Wear proper safety equipment.

3. Read operator's manual.



4. Check the engine to see if it has been serviced.

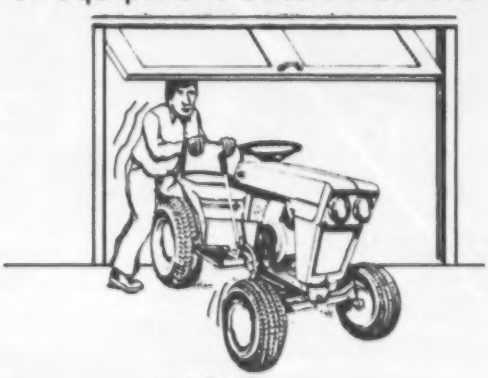




NOTE!

Before operating engine, always check the oil level.

5. Move the engine or equipment outside before starting.

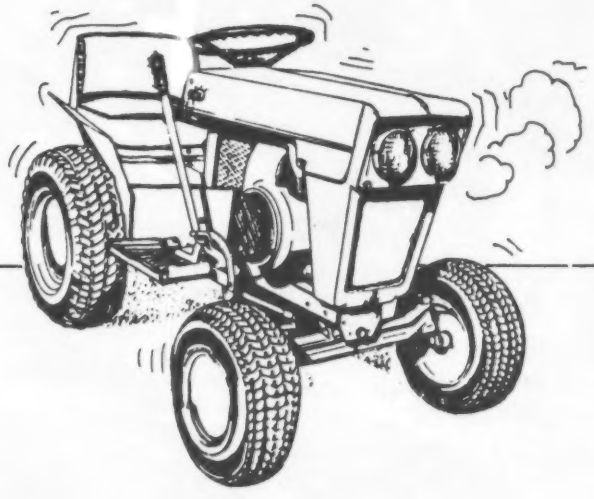


NOTE!

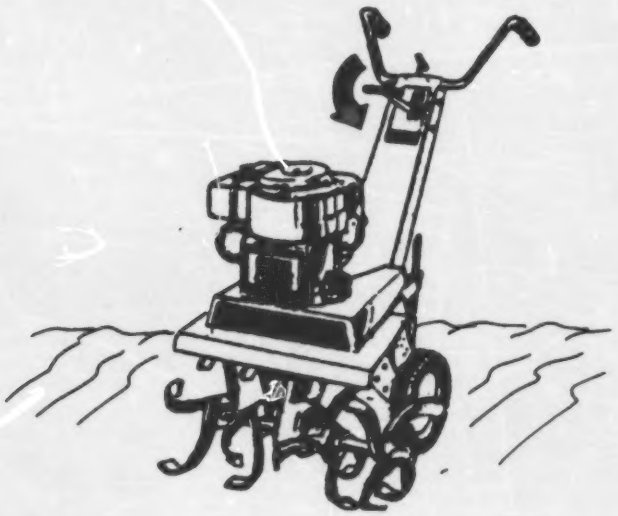
See your instructor before starting engine.

6. Check the area and make sure it is clean and free of any spilled gas on the floor.

7. Check the engine to see if it is well balanced.



8. Disengage clutch on all power-driven equipment before starting.



NOTE!

This is a safety measure and also relieves the load on the engine during cranking and warm-up.

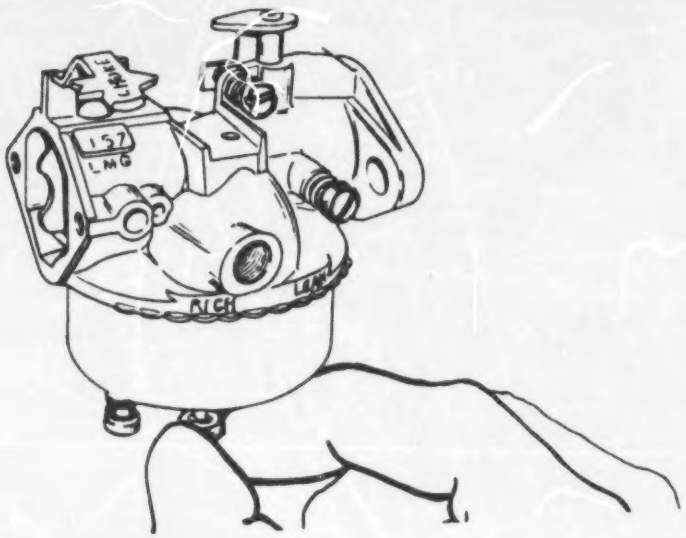
9. Remove the spark plug and crank engine several times.

NOTE!

This applies only when you are removing the engine from storage or a new engine.

This procedure will remove any excess oil from the cylinder that may remain from storage.

10. Adjust carburetor if needed.

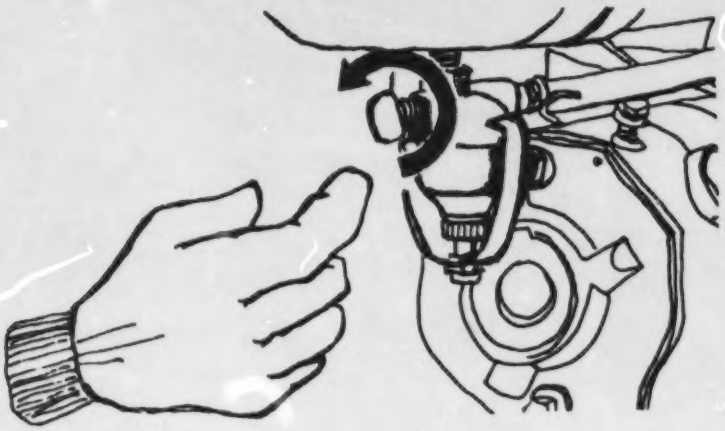


NOTE!

Most carburetors are preset at the factory. However, you may need to make some adjustments.

C. Steps in Operating Small Engines

11. Open the fuel shut-off valve if your engine is equipped with one.

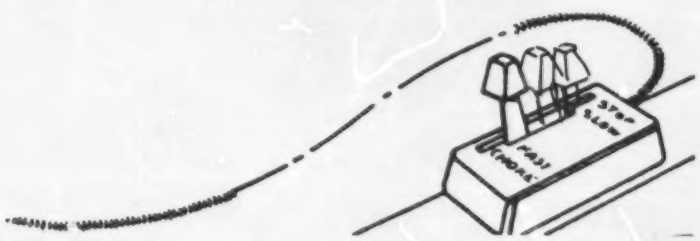


12. Close the choke valve or prime the carburetor.

NOTE!

Choking or priming accomplishes the same purpose.

13. Set the throttle at position recommended for your engine.



NOTE!

Usually 1/4 to 1/2 open is sufficient.

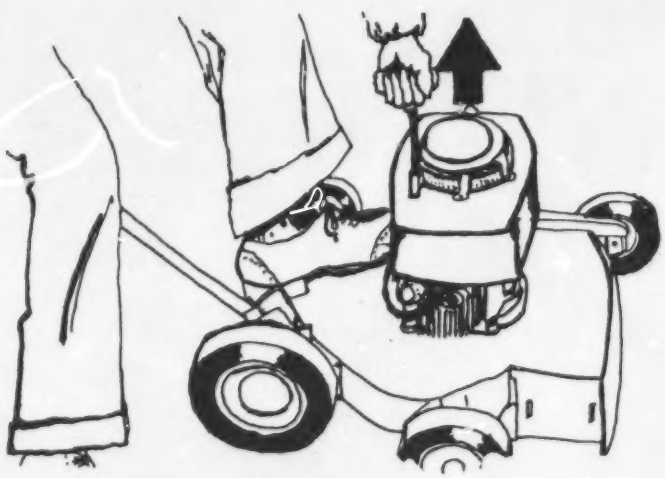
If your choke and throttle lever are combined, move lever to choke position for starting.

14. Turn on ignition switch if engine has one.

NOTE!

Some engines are equipped with a grounding switch. Make sure the grounding switch is "open".

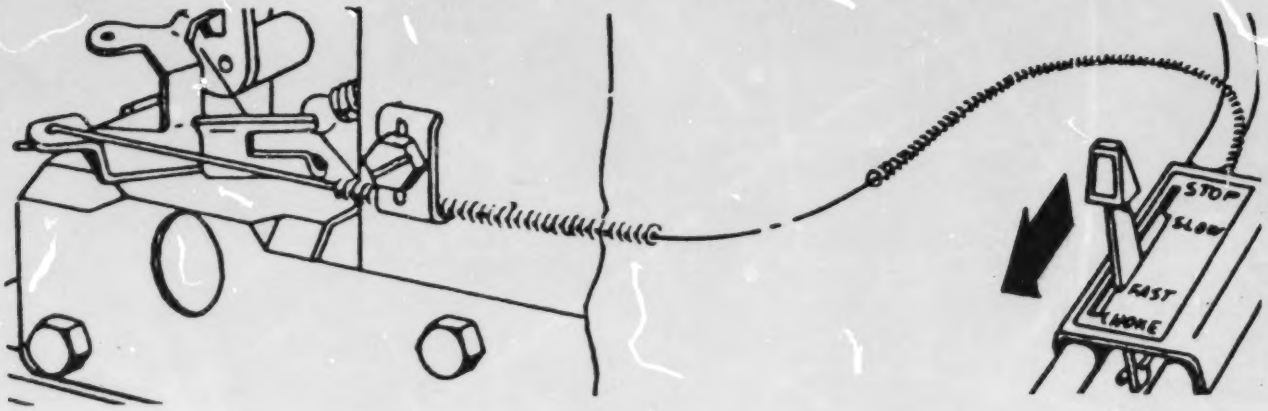
15. Start engine.



NOTE!

Check with your instructor before starting engine.

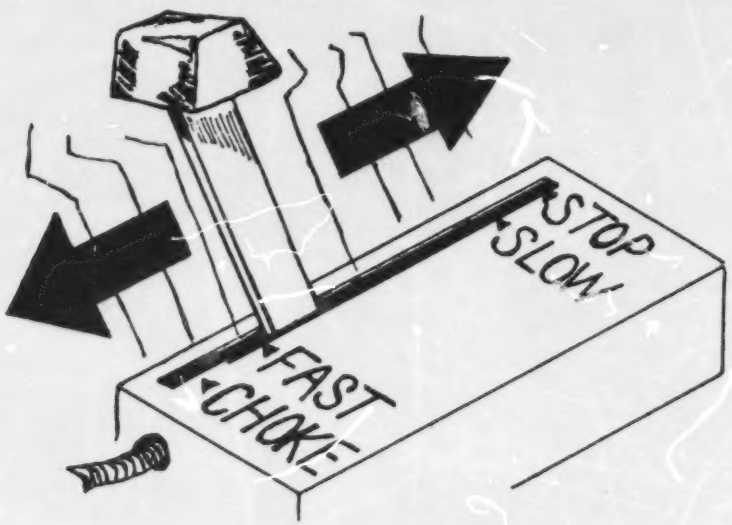
16. Correctly adjust the choke valve when the engine starts.



NOTE!

This applies to engines that do not have an automatic choke.

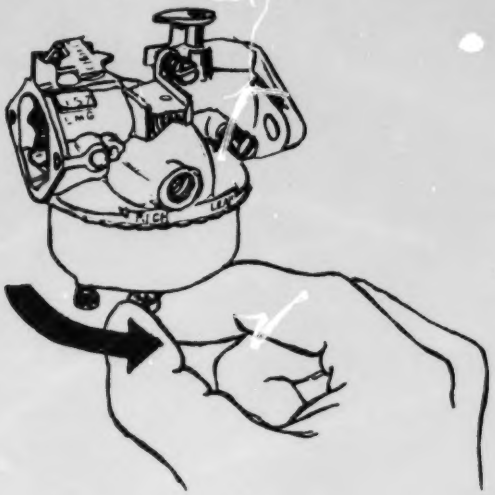
17. Adjust the throttle for warm-up.



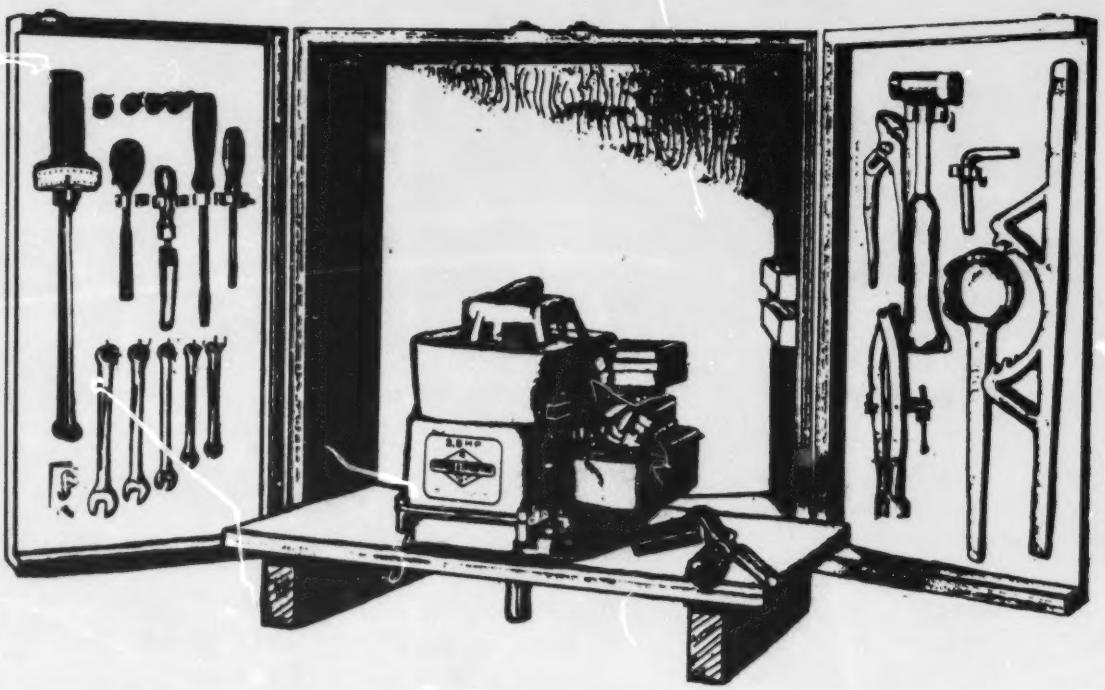
NOTE!

The engine should run at fast idle for 10 to 15 minutes.

18. Make final adjustments on carburetor if necessary.



19. Clean work area and return tools to their proper places.



SEE YOUR INSTRUCTOR

Unit 16
Starting and Operating Small Engines

Practical Exercise Performance Checklist

The student_____successfully performed the following tasks:

Tasks	Yes	No	Comments
Steps in Starting Small Engines			
1. Identified:			
a. Standard screwdriver			
b. Open-end wrench set			
c. Phillips screwdriver			
d. Spark plug wrench			
e. Socket wrench set			
f. Long-nose pliers			
g. Oil			
h. Operator's manual			
i. Shop towels			
j. Safety equip.			
2. Wore proper safety equipment			
3. Read operator's manual			
4. Checked engine to see if it had been serviced			
5. Moved engine or equipment outside before starting			
6. Checked area to make sure there was no spilled gas			
7. Checked engine to see if it was well balanced			
8. Disengaged clutch on power-driven equipment			
9. Removed spark plug and cranked engine (if needed)			
10. Adjusted carburetor if needed			

Tasks	Yes	No	Comments
Steps in Operating Small Engines			
11. Opened fuel shut-off valve			
12. Closed choke valve or primed carburetor			
13. Set throttle at recommended position			
14. Turned on ignition switch if present			
15. Started engine			
16. Opened choke valve correctly.			
17. Adjusted throttle for warm-up			
18. Made final adjustments on carburetor if necessary			
19 Cleaned work area and returned tools to their proper places			

Satisfactory Performance ☐
Repeat Exercise ☐
Should Move On ☐

_____ _____
Instructor's Signature Date